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ALBERTA GOVERNMENT COMMITTEE REPORT

ON

GREAT CANADIAN OIL SANDS

OIL SPILL

TO ATHABASCA RIVER

JUNE 6, 1970

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ALBERTA GOVERNMENT COMMITTEE REPORT

ON

GREAT CANADIAN OIL SANDS OIL SPILL TO ATHABASCA RIVER, JUNE 6, 1970

- Committee Chairman - H. L. Hogge
Director
Division of Environmental Health
Department of Health
- R. J. Allman
Pipe Line Engineer
Pipe Line Division
Department of Mines and Minerals
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Chief Fishery Biologist
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Department of Lands and Forests
- R. E. Bailey
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Water Resources Division
Department of Agriculture
- E. E. Kupchanko
Head
Water Pollution Control Section
Division of Environmental Health
Department of Health

August 12, 1970

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INDIVIDUAL REPORTS BY COMMITTEE MEMBERS
REPRESENTING THE FOLLOWING DEPARTMENTS ARE ATTACHED:

DEPARTMENT OF MINES AND MINERALS

DEPARTMENT OF LANDS AND FORESTS

DEPARTMENT OF AGRICULTURE

DEPARTMENT OF HEALTH

COMMITTEE REPORT ON OIL SPILL
GREAT CANADIAN OIL SANDS LIMITED

JUNE 1970

INTRODUCTION

The committee has reviewed the Great Canadian Oil Sands company's oil spill as to cause, effect, and also as to any lessons that may be learned from this particular incident. The report is our evaluation and assessment of the areas deemed to be most significant. Detailed work was carried out by the Departments of Lands and Forests, Mines and Minerals, and Health immediately after the oil spill occurred and this work continued until the direct problems were over. Summaries of this work have been prepared by the members of the committee and are attached. In addition, extensive liaison work with the company was carried out by the staff of these departments, particularly with regard to clean-up and control work on the river and lake. The company was consistently co-operative and receptive to requests and discussions, and made considerable effort to advise the government of their proposed actions. This combined co-operative work was extensive and complete in the continuing assessment of problems during the emergency and made significant progress to control critical areas and avoided mistakes which might have accentuated critical items. During the emergency, recognition of sincere efforts and the practical progress being made are often not recognized.

COMMITTEE REPORT ON THE
LANDS CANADA OIL LANDS
JUNE 1970

INTRODUCTION

The Committee has reviewed the work of the Lands Canada Oil Lands Program since its inception in 1967. It has found that the program has made significant progress in the development of the oil lands and in the management of the oil resources. The program has been successful in identifying and evaluating the oil lands and in developing a system of management that is based on the principles of sustainable development. The program has also been successful in developing a system of management that is based on the principles of sustainable development. The program has been successful in identifying and evaluating the oil lands and in developing a system of management that is based on the principles of sustainable development. The program has also been successful in developing a system of management that is based on the principles of sustainable development.

CIRCUMSTANCES OF THE OIL SPILL

The oil spill resulted from a failure of the pipeline carrying the synthetic crude oil produced by the Great Canadian Oil Sands Limited plant to the pipeline system at Edmonton, some 266 miles away. The break occurred at a wrinkle in a side bend of the pipe where the pipeline changed direction. It consisted of a split in the pipe wall longitudinally some 36 inches long, opening to 4 inches wide at the centre. The failure was investigated in detail and determined to be a construction defect contrary to the construction standards approved by the Department of Mines and Minerals. There was no indication that this was anything more than an isolated and single construction shortcoming, however it is recommended that consideration be given to have this aspect reviewed and assessed.

The sequence of events at the time of the break may be summarized as follows:

- (1) Pressure fluctuations at the pump station noted at 1:45 p.m., June 6th.
- (2) Leak located by 6:00 p.m., June 6th, by aircraft patrol.
- (3) Completion of an earth dam on the drainage course to the river and a diversion ditch over to the plant's sand tailings pond by 9:45 p.m., June 6th.

The pipeline break occurred approximately one and a half miles south of the processing plant and at that point the pipeline is one-half mile west of the Athabasca River. No accurate estimate of the amount of oil that reached the Athabasca River can be made.

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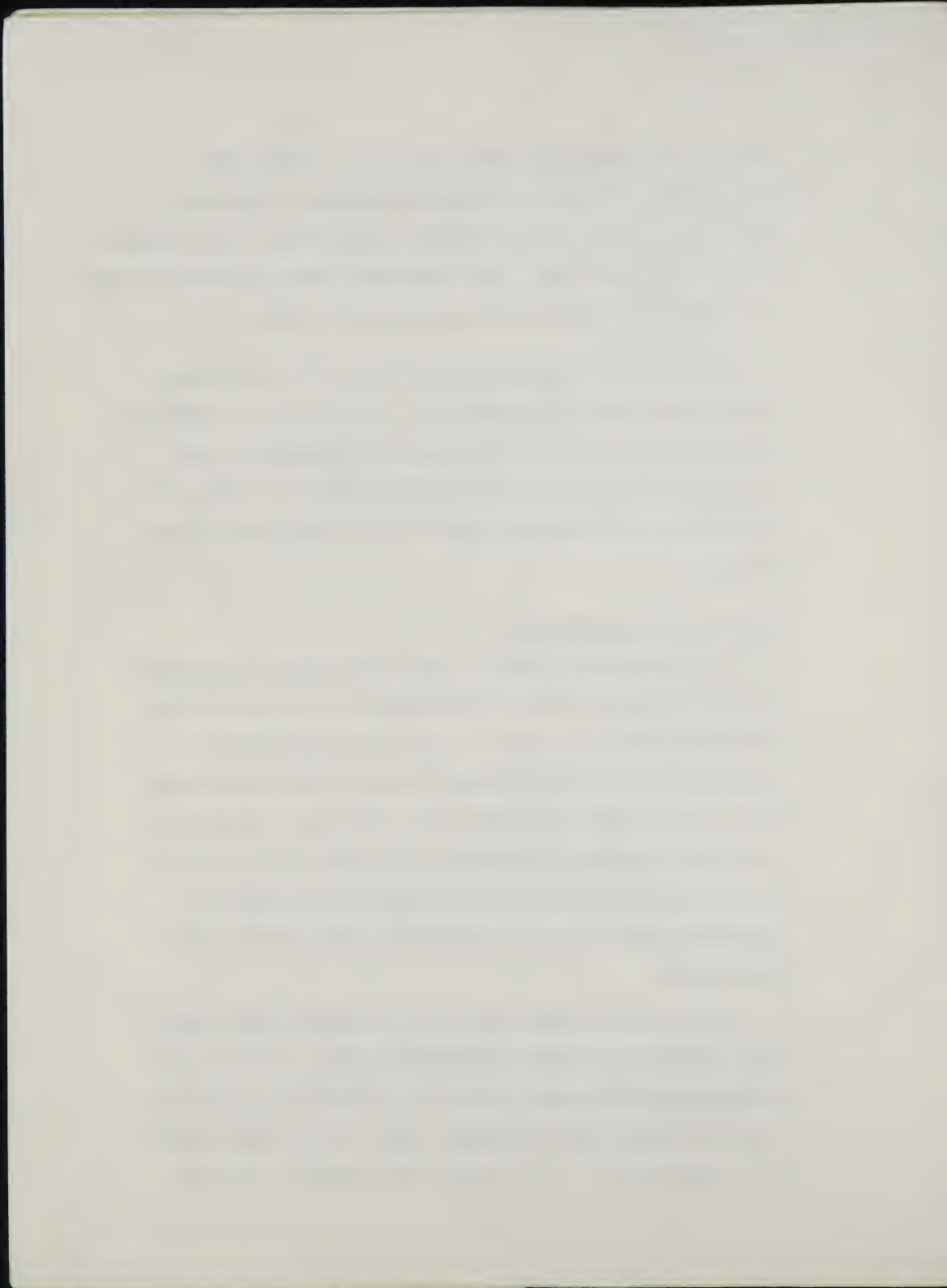
However, Great Canadian Oil Sands Limited has estimated that 19,123 barrels of oil were lost from the pipeline. Appreciable quantities did reach the river and were visible down to Lake Athabasca, some 150 miles downstream. The oil was also visible in certain sections of the west end of the lake for approximately six days.

The pipeline was constructed in 1965 and 1966 and has been in actual operation for some three years. At the time of the break the pipeline was carrying oil at the rate of 51,600 barrels per day (2,150 barrels per hour) at a pump station pressure of 1410 p.s.i. This was within the approved design of 57,000 barrels per day and 1440 p.s.i.

BEHAVIOR OF OIL ON THE RIVER

The oil was carried down the river quite quickly. In two days it was carried approximately 90 miles down the river, mainly along the westerly bank of the river. In the next two days the oil proceeded down to the delta area and the oil started to be noticeable in Lake Athabasca three days later (June 13th). During the next five to six days oil continued to be visible in the westerly portion of Lake Athabasca, however by June 20th essentially all noticeable evidence of oil had disappeared, both from the river and the lake.

The oil was noticeable mainly as an iridescent sheen, particularly visible from aircraft surveillance checks. At times oil in an emulsified state covered portions of the river and accumulated in a few backwater areas in definite layers. Only limited amounts of the emulsified oil, or oil layers were detected in the lake.



JOINT ACTION BY COMPANY AND GOVERNMENT OFFICIALS

Government officials were advised of the incident during the evening of June 6th and the company worked in close co-operation with the government during clean-up and surveillance programs. The Provincial Government departments most actively involved were the Pipe Line Division, Department of Mines and Minerals; Fish and Wildlife Division, Department of Lands and Forests; and the Division of Environmental Health, Department of Health. It is noted also that the Canadian Wildlife Service and the Federal Department of Indian Affairs and Northern Development were active in the surveillance, control and clean-up operations at a later date. The reports prepared by the members of this committee indicate the assessments made, but do not include the detailed work that was done between the staff members and the company directly as the clean-up and control work proceeded.

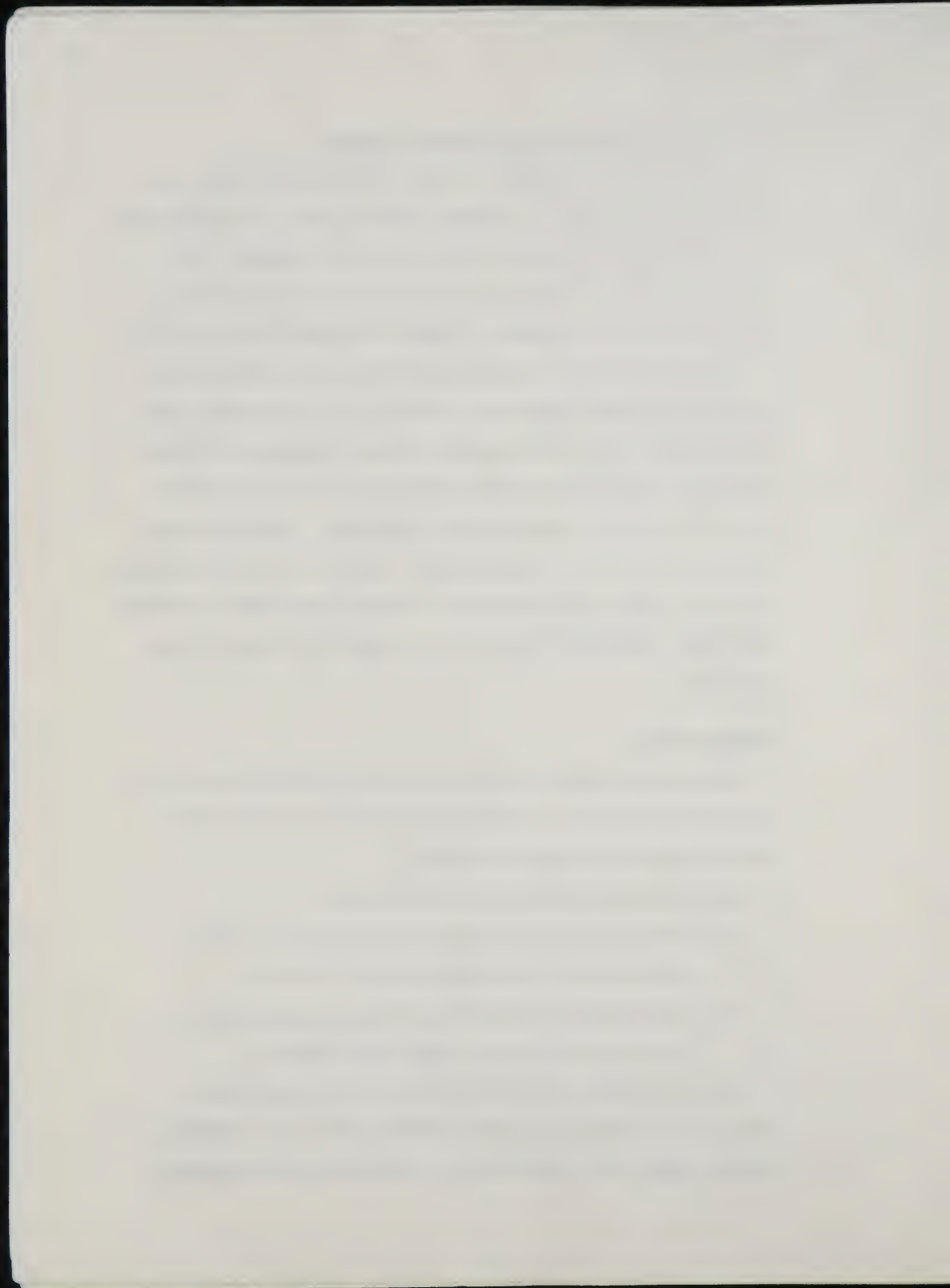
ADVERSE EFFECTS

The adverse effects on fish and wildlife, and other uses of the river were not extensive. Noticeable oil did not persist in the river and lake for more than two weeks.

The most marked effects were the following:

- (1) Use of the river as a source of water supply by the communities at Fort MacKay and Fort Chipewyan.
- (2) Interruption of commercial fishing in the area near the junction of the river and Lake Athabasca.

Possible effects on fish and wildlife were studied quite closely and no evidence of actual adverse effects were observed, except a beaver that had become oil covered which caused apparent



distress and the beaver was killed by the observer.

Lasting or long-term effects will be checked further, however at this time there is no indication that there is any continuing type of adverse effect.

GOVERNMENT SUPERVISION OF PIPELINES

Oil pipelines in Alberta are under the jurisdiction of the Department of Mines and Minerals. There are specific standards for the design, construction, and testing of pipelines. The operation of pipelines is also kept under review, as is the requirement of safety precautions by the pipeline companies. In addition the safety standards are reviewed twice yearly by a nationwide government - industry committee, and the Department of Mines and Minerals is represented on this committee.

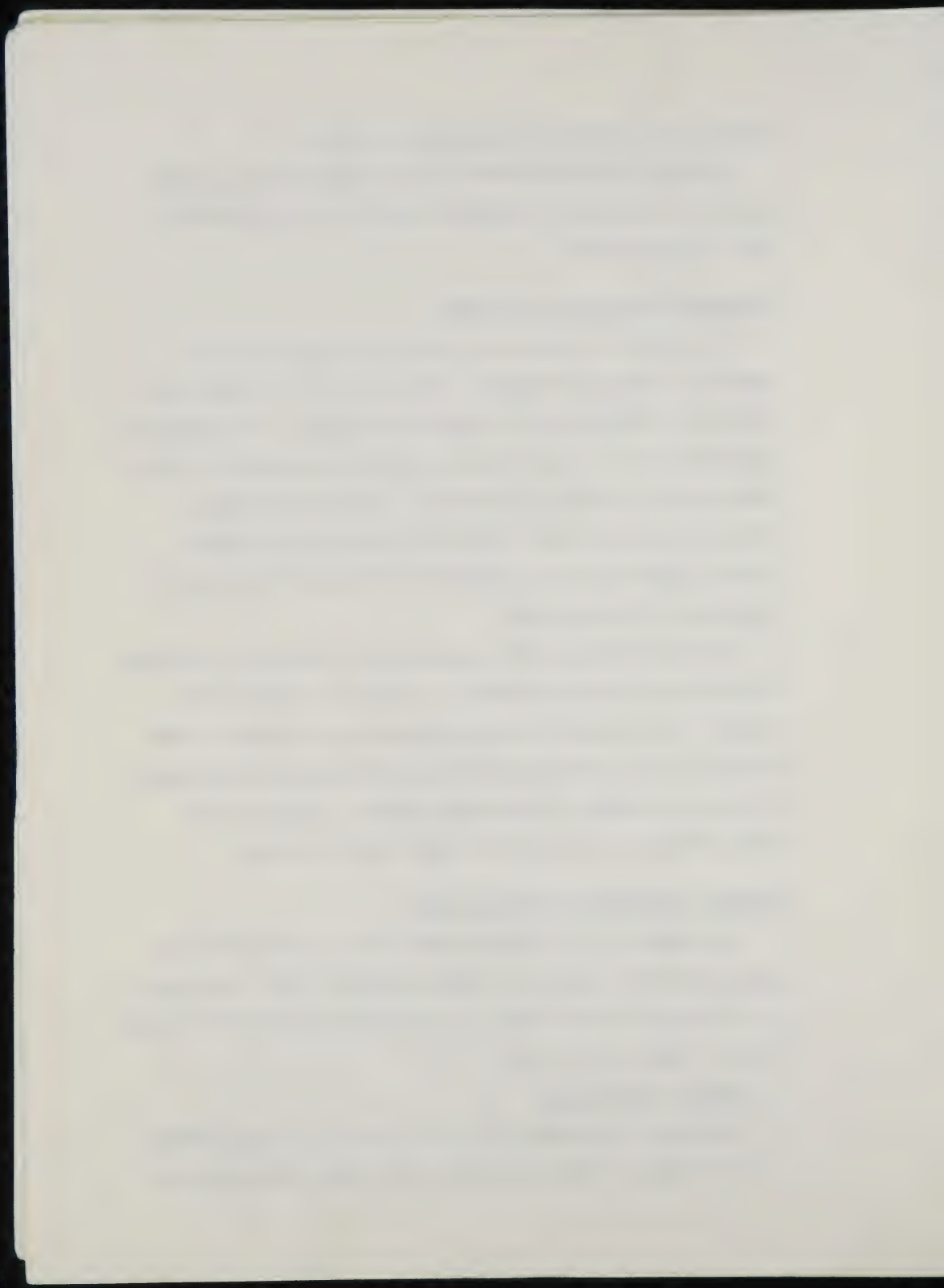
It is noted that in 1969 there were some 8,300 miles of pipelines in Alberta and 340 million barrels of oil and oil products were carried. The frequency of pipeline breaks is low and many of these are caused by dirt moving equipment, and other causes not associated with pipeline design or construction factors. Failures of the type experienced in this pipeline break occur very rarely.

FINANCIAL IMPLICATIONS OF THE OIL SPILL

The escape of oil to surface waters could in some cases cause damages having both direct and indirect financial loss. In the case of the Athabasca River oil spill, these damages and financial implications are summarized as follows:

1. Community Water Supply

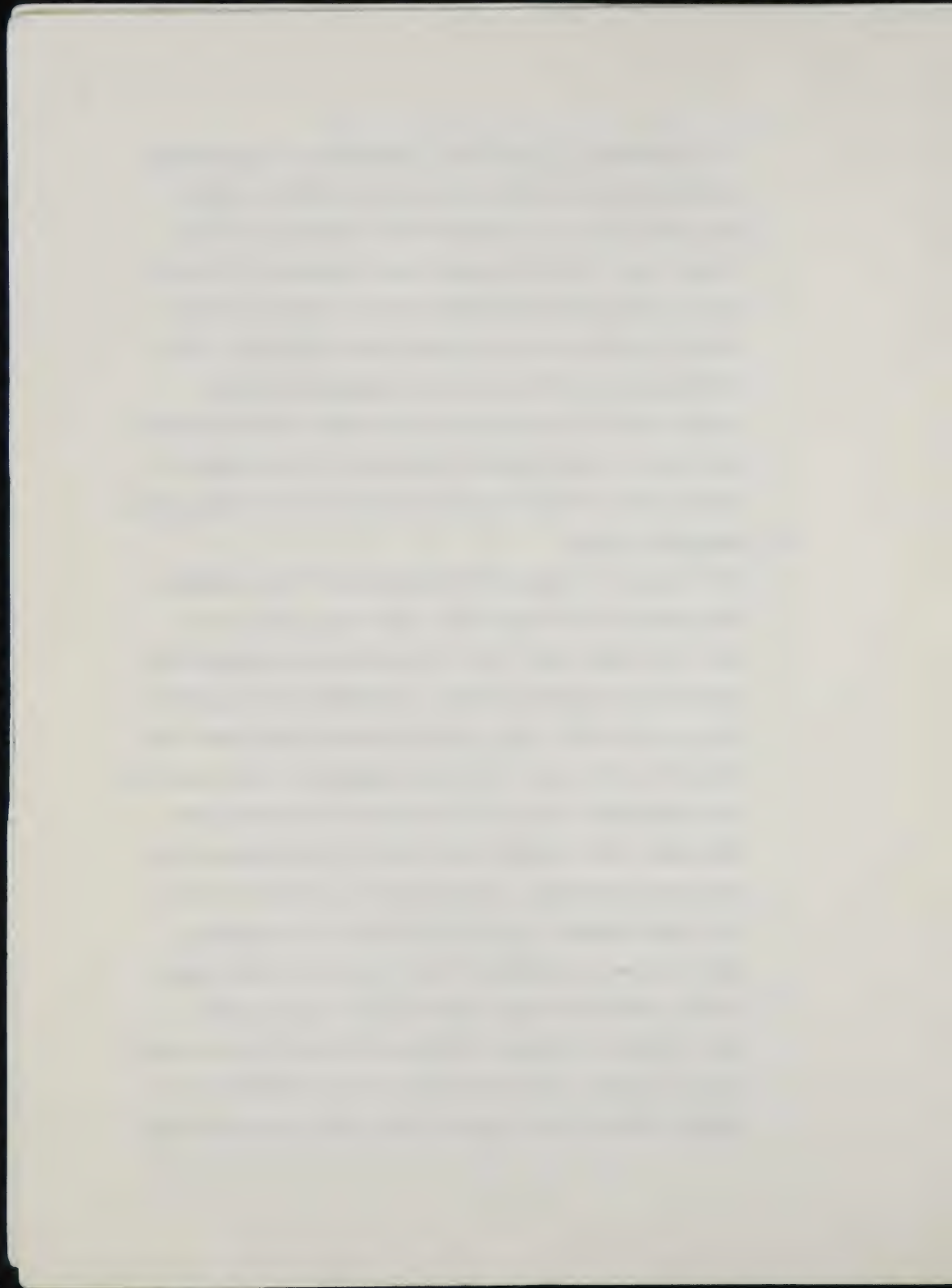
The effect at Fort MacKay as to the use of the Athabasca River for household water was minimal as the company delivered water



to the community. In addition, some members of the community normally use other surface water or well water as a source, particularly when the Athabasca River is muddy during high summer flows. At Fort Chipewyan, Lake Athabasca is the traditional source of water and during the few days that oil was present in this area, other sources had to be sought. A few residents use water wells and some buildings have water intake pipes out into the lake, however these were not affected. The extent of inconvenience or extra cost in this regard was nominal due to the short period of time that the oil was present.

2. Commercial Fishing

The commercial fishing in the westerly end of Lake Athabasca was scheduled for a seven weeks' season this year, that is May 11th to June 30th. Due to ice conditions the fishing did not get under way until May 30th. The fishing was stopped for ten days, June 10th - 20th, but the scheduled open season was extended to July 15th. This would compensate to some extent for the interruption, but not fully as some of the prime season was missed. Also the high flood flows in the Athabasca River from about June 20th on, which brought a great deal of debris into Lake Athabasca, interfered with good fish harvesting. Thus there was a significant loss of revenue to those engaged in this commercial fishing operation due to the oil spill. Sport fishing is minimal in the area affected. Thus, the short period of effect, and the fact that fish were apparently not directly affected would make any sport fishing loss quite small.



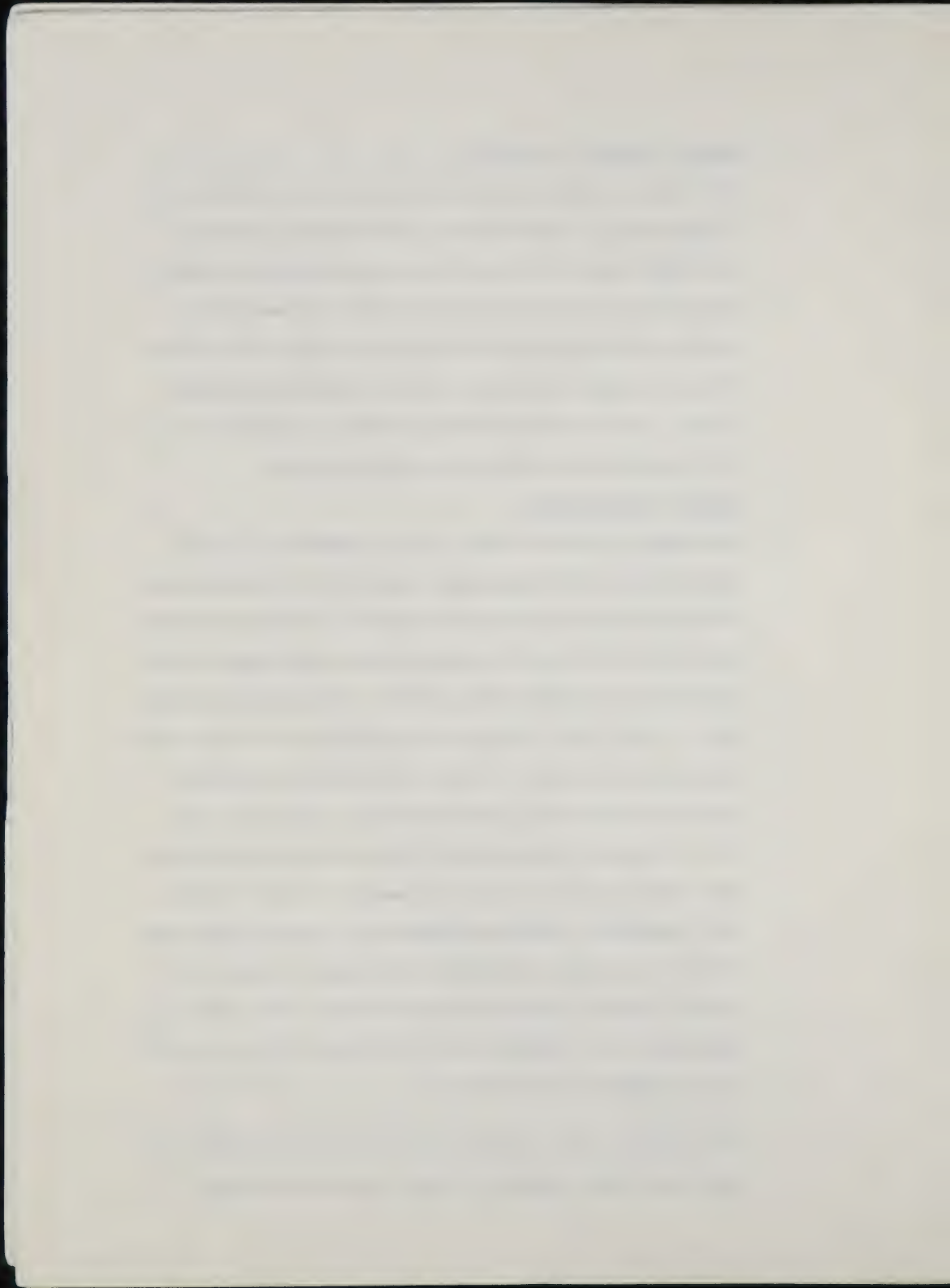
3. Alberta Government Supervision

The Alberta Government departments which have jurisdiction or responsibility in the assessment, supervision or control of the pipeline and the oil spill all carry extensive programs. The reports of these departments indicate the nature and extent of the special work done on this project. This extra work was assumed immediately and as a supervisory responsibility. In some instances the departments incurred costs over and above those which are normally incurred.

4. Federal Government Work

The Canadian Wildlife Service and the Department of Indian Affairs and Northern Development were active in the assessment of adverse effects on fish and wildlife, the efforts to control the travel of oil and the removal of oil, particularly in the area within Wood Buffalo National Park. The possible movement of oil to the north via Riviere des Rochers and the Slave River also received attention. Some of this work was undertaken directly and some was proceeded with as a 'task force' with Dr. D. Stephen of the Canadian Wildlife Service as the leader. This task force was set up on the weekend of June 13 and 14, with discussions between the Department of Indian Affairs and Northern Development, the Alberta Department of Lands and Forests and Great Canadian Oil Sands Limited. The task force was active for a relatively short period only as the oil was not noticeable after June 20th.

The committee notes that there have been certain statements made that Great Canadian Oil Sands Limited would be held



financially responsible for expenses incurred in connection with the oil spill. Notwithstanding this, the company participated actively with the task force and was appreciative of assistance given to them.

CONTROL OF ADVERSE EFFECTS OF OIL SPILLS

Normally, the extent of adverse effects would vary directly as to the volume and extent of travel of the oil, and also whether or not it reaches a body of surface water. The committee has considered each of these aspects for the purpose of assessing potential ways and means of minimizing the adverse effect of any future incident.

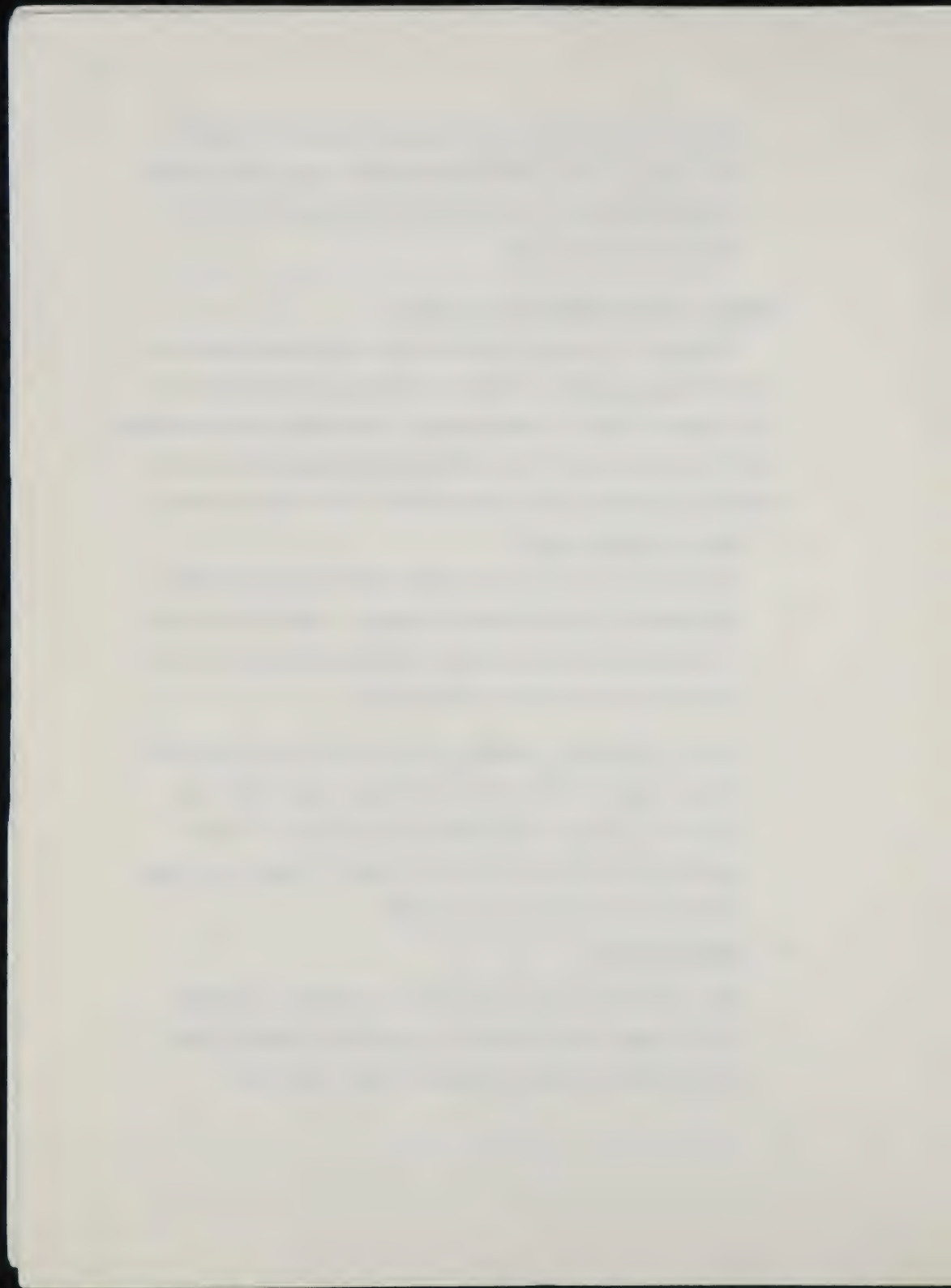
1. Reduction of Loss of Oil

The loss of oil by drainage through a pipeline break may be significant in certain types of terrain. Current practice is to locate block valves and check valves at strategic locations to minimize the loss of oil from breaks.

Of prime importance, however, is early detection of a pipeline break. Specific rate of flow detectors at each end of the pipeline, suitably co-ordinated and connected to an alarm warning system, particularly on the larger diameter and longer pipelines could assist in this regard.

2. Extent of Travel

This will depend on the volume of oil released, the nature of the terrain and the ability to construct retaining berms or impoundments. Early detection is again important.



3. Protection of Surface Water

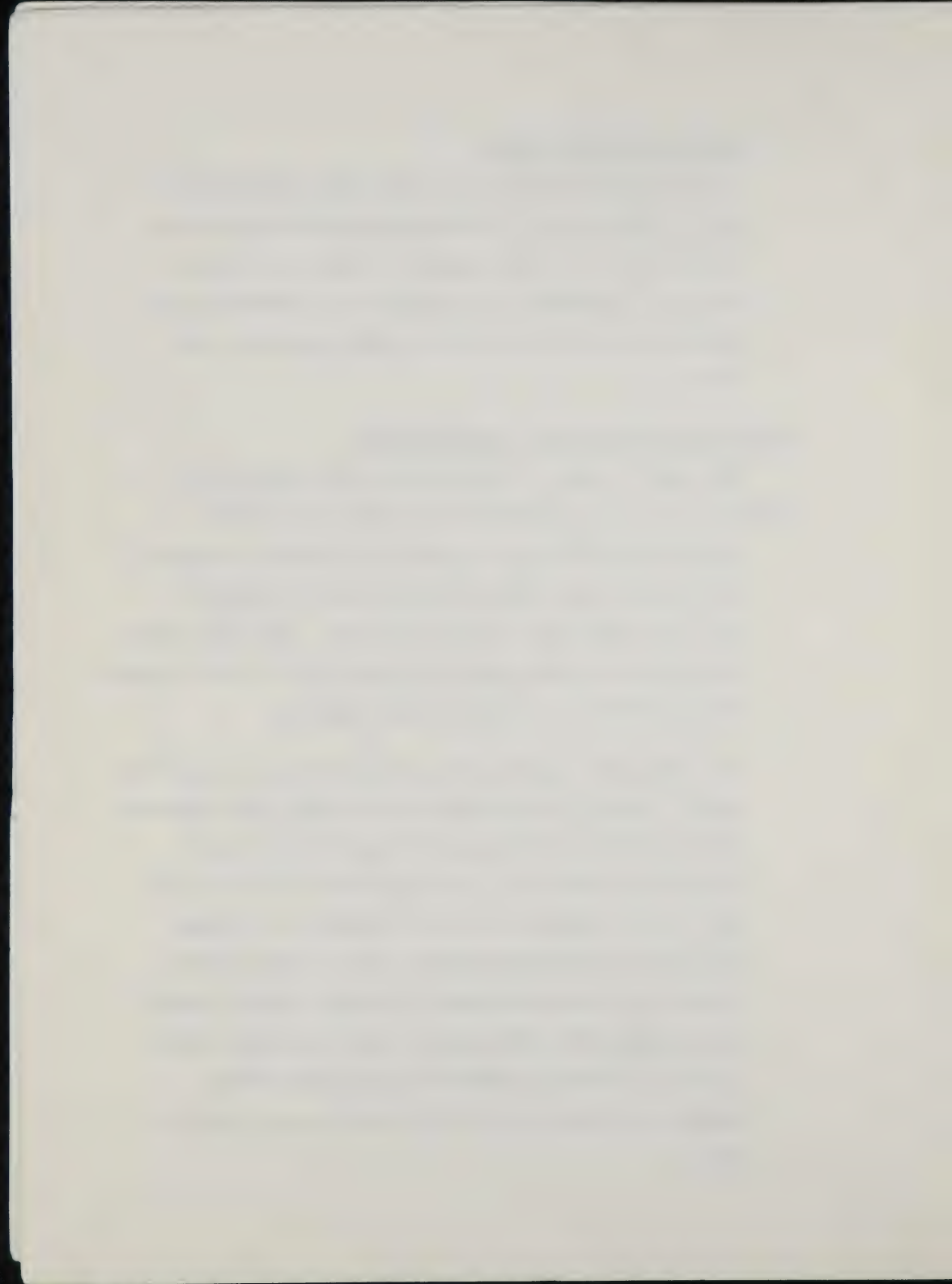
Current standards require additional pipeline safety factors at all river crossings. Consideration should be given to the extension of this to areas adjacent to rivers, e.g. within one mile. The benefit of this would be most significant near larger rivers and where the ground slopes definitely to the river.

CLEAN-UP AND CONTROL OF OIL ON SURFACE WATERS

This aspect is dealt with quite fully in the Department of Health's report and the committee would summarize as follows:

On lakes and other bodies of water the oil spread is relatively slow. Recovery and removal of the oil would be feasible if suitable equipment and staff were available. Early action would be important as strong winds could spread the oil so that recovery would be difficult and adverse effects augmented.

On streams and rivers the travel and spread of oil is relatively rapid. Rivers in prairie land, away from steep sloped mountains and foothills will be flowing at a velocity of some two to four feet per second (32.7 to 65.4 miles per day) most of the year. Any oil reaching the river is carried with the water and recovery is difficult because of the extensive spreading of the oil and the fast movement of the water and oil. Specialized techniques would be required to make significant recoveries of oil. Clean-up operations also would be difficult because of the length of travel and rugged terrain along the banks.



Because of the nature and complexity of clean-up and control operations, it is recommended that the oil industry and pipeline companies be requested to consider the organization of a joint program for this purpose. The need for speedy action at the time of a spill is extremely important, and this is essentially dependent on the availability of suitable equipment and knowledgeable staff.

It would be helpful to have an official Government committee designated for the purpose of assisting with, and supervising clean-up and control operations of any future incident of this nature. The Government committee could work with the joint group in the planning stages and also in operational work.

SUMMARY

The adverse effects of this oil spill were relatively small. Nuisance effects were minimal because of the relatively sparse settlement and development of the affected area. Fish, waterfowl, and river biota effects were studied closely and found to be negligible. For a short time, adverse effects were experienced in commercial fishing and in obtaining water at two communities. Long term effects will be checked for, but there is no indication that these will be noticeable.

Considerable clean-up and control efforts were made by Great Canadian Oil Sands Limited immediately after the oil spill occurred and were continued until completed. The most effective one was

1. The first part of the report deals with the general situation of the country and the progress of the work during the year. It is divided into two main sections: the first section deals with the general situation of the country and the progress of the work during the year, and the second section deals with the specific results of the work.

2. The second part of the report deals with the specific results of the work. It is divided into three main sections: the first section deals with the results of the work in the field of agriculture, the second section deals with the results of the work in the field of industry, and the third section deals with the results of the work in the field of commerce.

3. The third part of the report deals with the conclusions and recommendations. It is divided into two main sections: the first section deals with the conclusions and the second section deals with the recommendations.

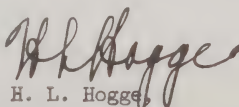
4. The fourth part of the report deals with the appendix. It contains a list of the names of the persons who have taken part in the work, a list of the names of the persons who have given evidence, and a list of the names of the persons who have been consulted.

the early diversion of escaping oil to a pond, thus preventing its continued flow to the river, and the use of booms to prevent the spread of oil to lake areas in the delta area. Work to remove oil from the river was not very successful due to the thin film of oil on the river and the rapid flow of the river. Accumulation of oil to a definite layer occurred in some backwater sections of the river, but these were often located in remote areas and lasted for only a short period of time. The use of chemical dispersants was limited because of possible interference with the removal of oil work and the possible increase in a toxic hazard to fish, general water biota, and to household water use.

Extensive surveillance and assessment work was done by the company and by agencies of the Provincial and Federal Governments. The company maintained an open door to suggestions and requests, and kept the agencies advised of their work, problems and progress.

The committee's review of this incident has included the assessment of ways and means of prevention, control and restoration. This has been difficult; significant improvements have to be practical, not just theoretical. Probably one of the most important suggestions is the one recommending additional instrumentation of pipeline flow to give early detection of a pipeline break. We must recognize the extreme difficulty of removing oil from a flowing river or controlling the spreading of the oil. Specialized equipment and staff, and ready availability of the same, would be expected to make some progress in this difficult area. Preplanning and 'joint' industry and 'joint' government organizations could also be advantageous.

August 12, 1970.


H. L. Hogge,
Committee Chairman.

2. The second part outlines the specific procedures and protocols that must be followed when recording transactions. This includes details on how data should be collected, stored, and reviewed to ensure its integrity and reliability.

3. The third part addresses the role of the management team in overseeing the record-keeping process. It stresses that management must ensure that all staff are properly trained and that the necessary resources are provided to support the system.

4. The fourth part discusses the importance of regular audits and reviews to identify any discrepancies or areas for improvement. It suggests that these should be conducted at regular intervals and by independent parties to maintain objectivity.

5. The fifth part concludes by reiterating the commitment to high standards of record-keeping and the expectation that all staff will adhere to the established guidelines.

A D D E N D U M - OCTOBER 1, 1970

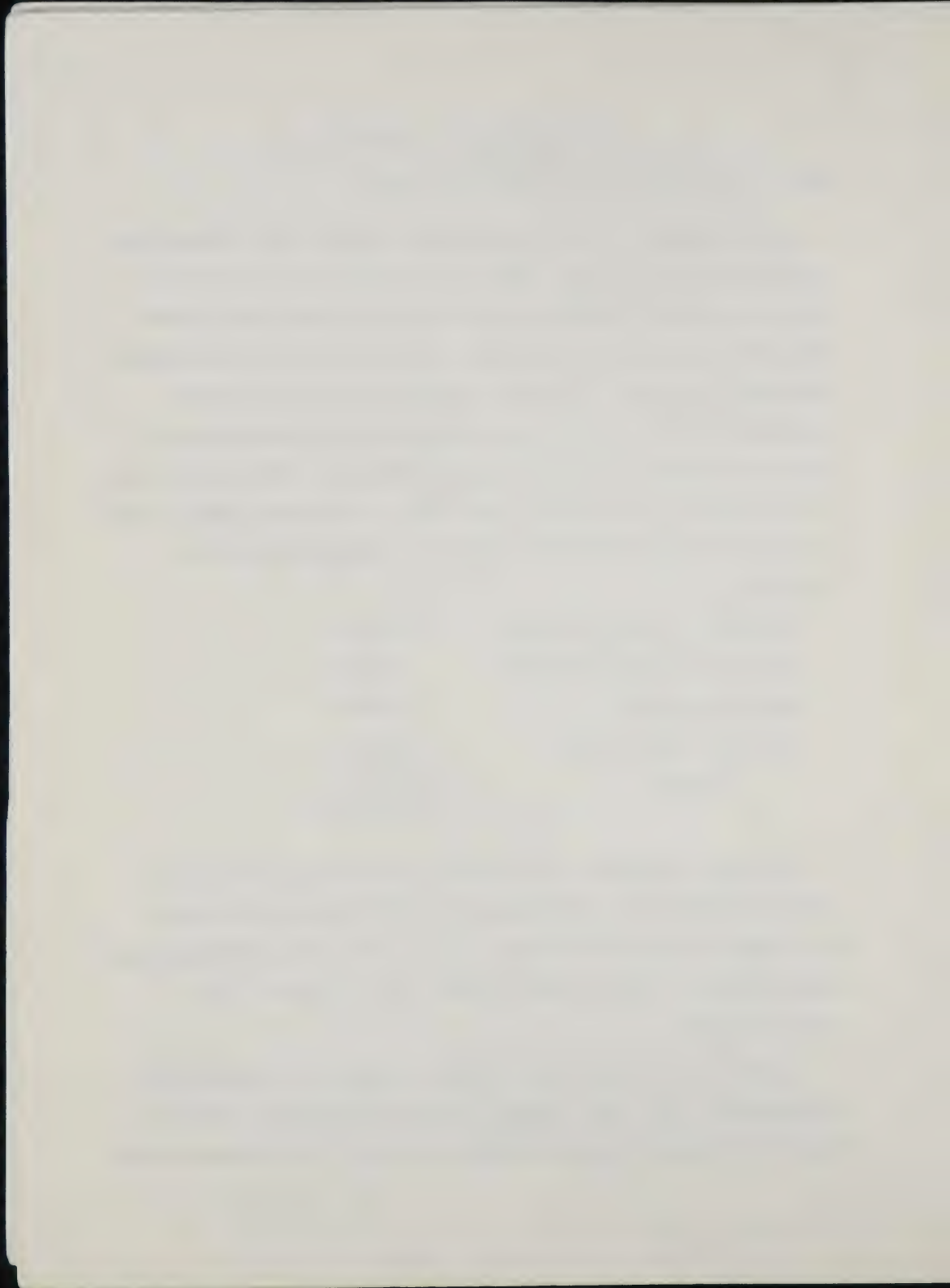
Item "3" - Alberta Government Supervision - page 7

Further information on this item has been obtained since the report was completed on August 12, 1970. This information is being included here to provide more specific information as to the cost of supervisory or effect assessment by the Provincial Government. Some of these costs also include work closely allied with the clean-up operations, however the largest percentage of the cost is directly associated with the supervisory and control work carried out by the Provincial Government. The committee would mention that this supervisory and control work is undertaken directly, both as part of normal programs, and in the case of unexpected incidents or emergencies.

Department of Lands and Forests	\$ 4,966.18
Department of Mines and Minerals	235.21
Department of Health	1,136.63
Department of Agriculture	<u>nil</u>
Total	<u><u>\$ 6,338.02</u></u>

The committee has also taken advantage of this review opportunity to update the submission by the Department of Agriculture committee member. The information contained previously was in the form of an interdepartmental memorandum and this has been updated as an item for inclusion in the committee report.

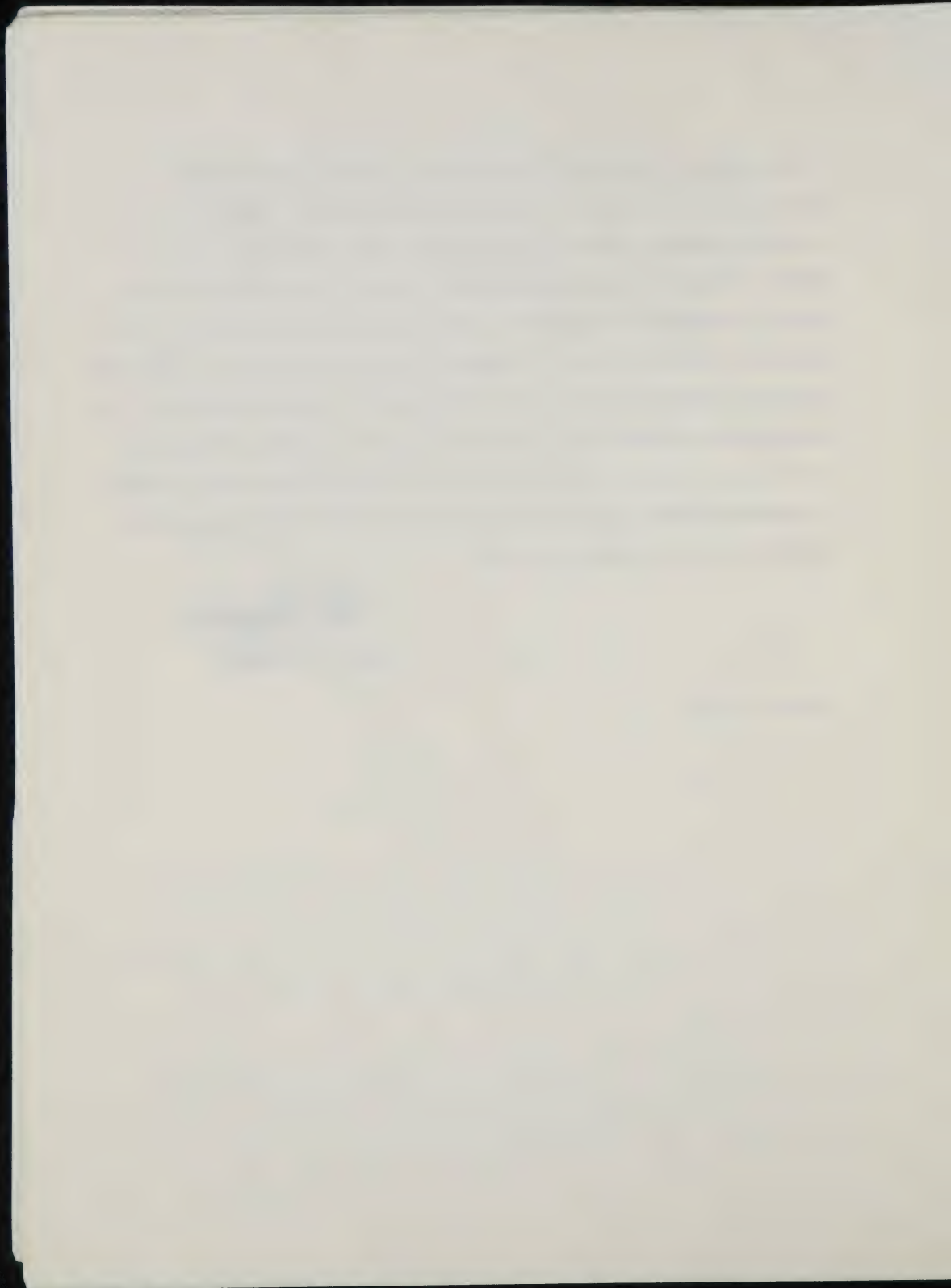
In addition, the initial report has been reviewed in a general way as to improvements which might be made in presenting information directly related to the pipeline break and subsequent oil spill to the Athabasca River.

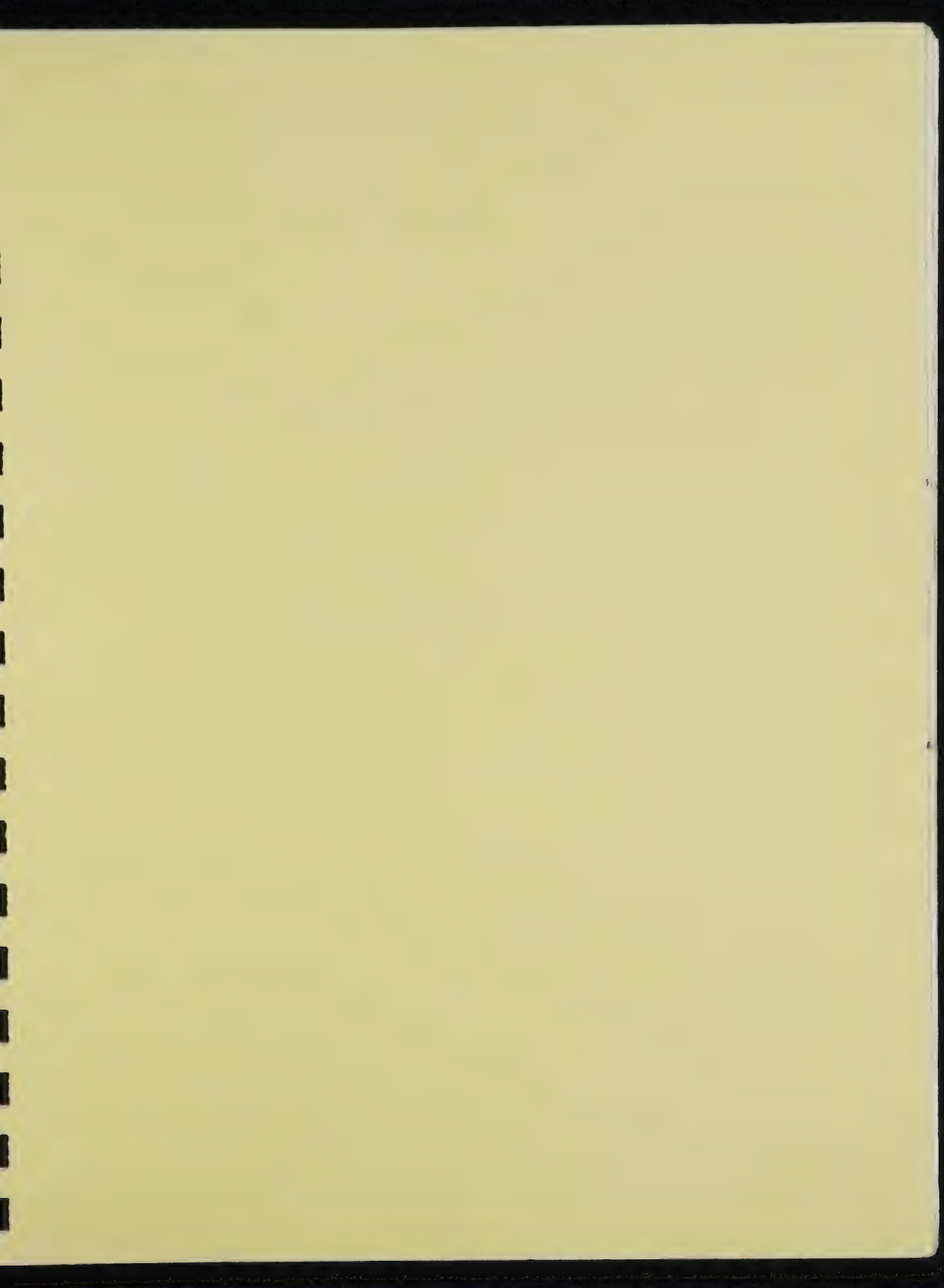


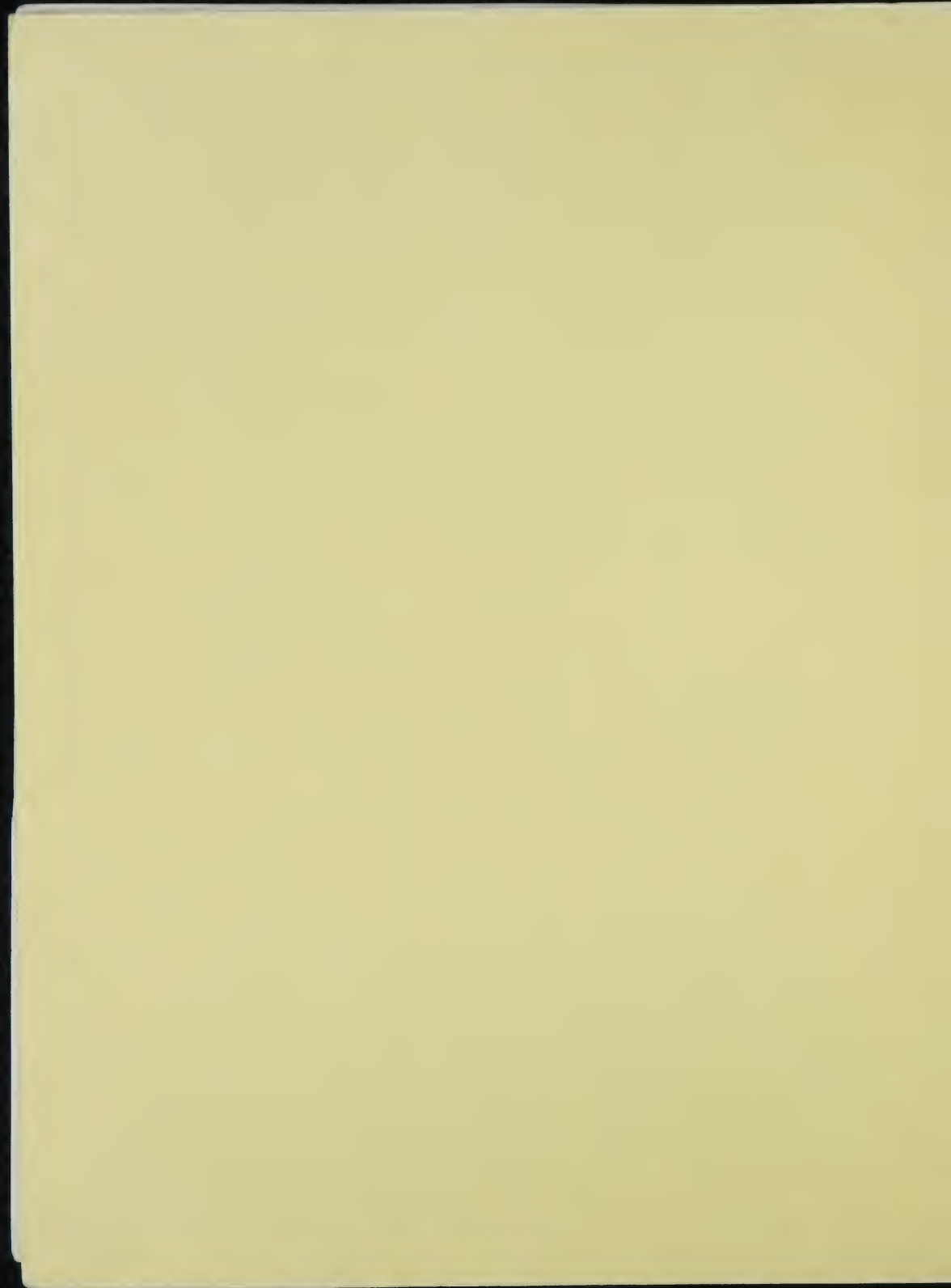
In particular, the report by the Department of Health was reviewed at some length as the section on "Reflections and Comments" (pages 8 to 15) is mainly general in nature on the subject of 'oil spills' and only indirectly related to the Athabasca River oil spill. This section could be deleted to advantage in keeping the report shorter and to the point. However, the committee felt that the general information may assist by providing background information and by summarizing current technology available. The committee does, however, wish to emphasize that the physical circumstances at the area in which the oil spill occurred must be recognized and evaluated in determining what type of control and clean-up work will be appropriate and effective in that particular case.


H. L. Hogge
Committee Chairman

October 1, 1970.







Report respecting the break occurring on
June 6, 1970 in the oil pipe line of
Great Canadian Oil Sands Limited

by

R. J. Allman
Pipe Line Engineer
Department of Mines and Minerals

Edmonton, Alberta

August 7, 1970



CONSTRUCTION OF THE PIPE LINE

Great Canadian Oil Sands Limited applied to the Department of Mines and Minerals for authority under The Pipe Line Act, 1958, to construct an oil pipe line from its oil sands plant located some 20 miles north of the town of Fort McMurray to the terminal of Interprovincial Pipe Line Company east of Edmonton. The Superintendent of Pipe Lines and his engineering staff reviewed the design and specifications of the pipe and installations proposed to be used in constructing the pipe line and they established that the pipe and installations proposed were technically satisfactory.

The permit authorizing the construction of the portion of the pipe line from the plant southerly to a point about five miles southeast of Redwater was granted on September 9, 1965 and the permit authorizing the construction of the remainder of the pipe line to the Edmonton terminal was granted on September 23, 1965.

The pipe line was constructed in 1965 and 1966 by Canadian Bechtel Limited. Test procedures were prescribed by the Superintendent of Pipe Lines and upon completion of the construction the pipe line system was hydrostatically tested with water to a static pressure of 125% of the proposed maximum operating pressure. These tests were witnessed and performed to the satisfaction of pipe line inspectors of

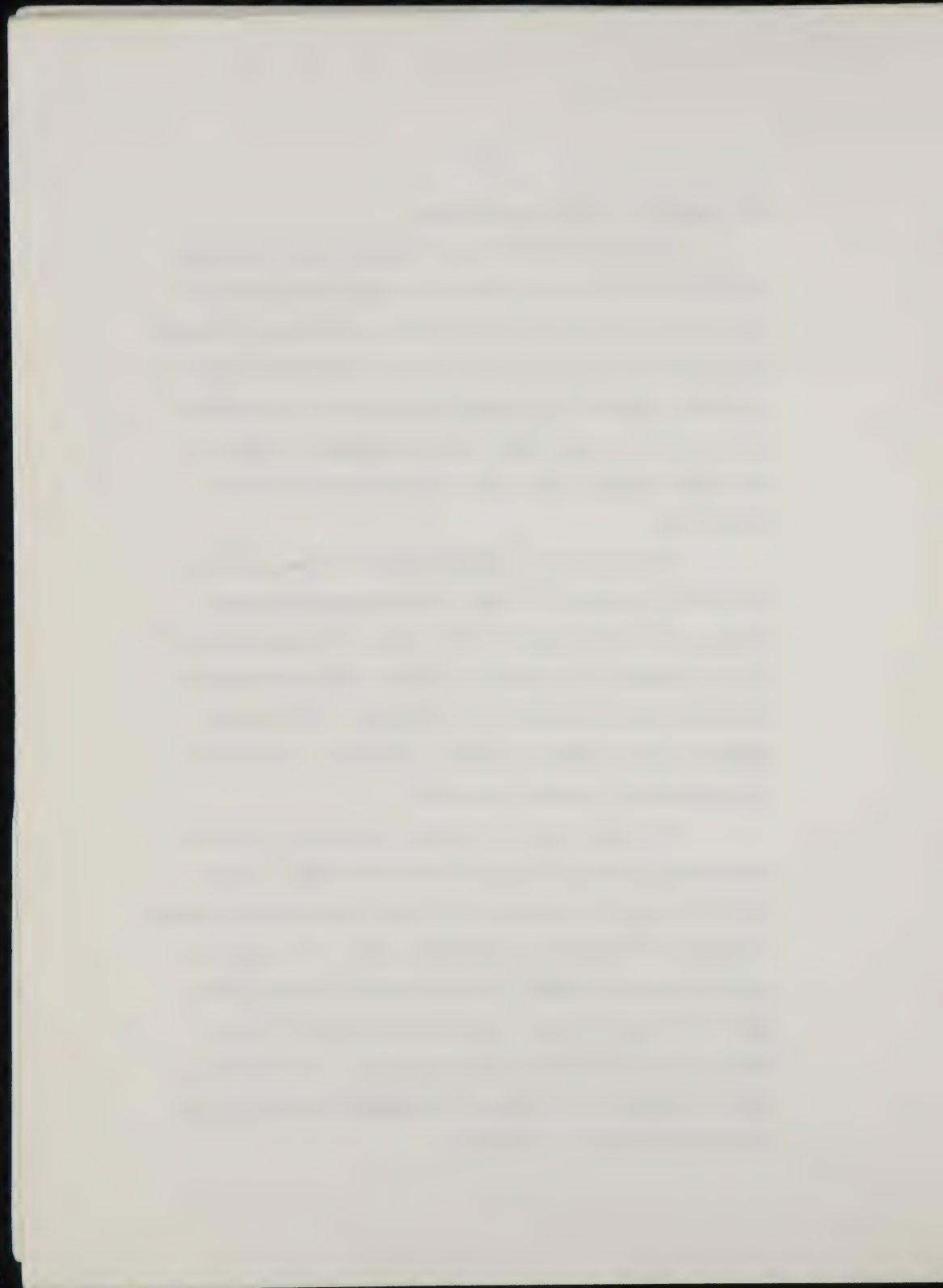


the Department of Mines and Minerals.

On August 22, 1966 a provisional licence was granted under The Pipe Line Act, 1958 to the company for operation of the pipe line. When the plans indicating the surveyed location of the land in which an interest had been acquired for the pipe line were available, the company applied for a licence under the Act and the licence was issued on September 28, 1967 by the Superintendent of Pipe Lines and the licence is still subsisting.

The pipe line is approximately 266 miles long, has an outside diameter of 16 inches, and has wall thicknesses varying from 0.312 inches to 0.203 inches. The pipe installed at the crossings of the Athabasca and the North Saskatchewan Rivers has a wall thickness of 0.500 inches. The pipe line along its entire length is coated, wrapped, and cathodically protected against external corrosion.

The pump station is located at the plant site where the synthetic crude oil is stored after processing. Three mainline pumps are installed in the pump station and are capable of pumping 57,000 barrels of synthetic crude oil a day. The maximum operating pressure for the northerly 24 miles of the pipe line (0.312 inch wall thickness) is 1440 psig, for the next 27.5 miles (0.281 inch wall thickness) is 1315 psig and for the remaining 214.5 miles to the Edmonton terminal (0.203 inch wall thickness) is 950 psig.

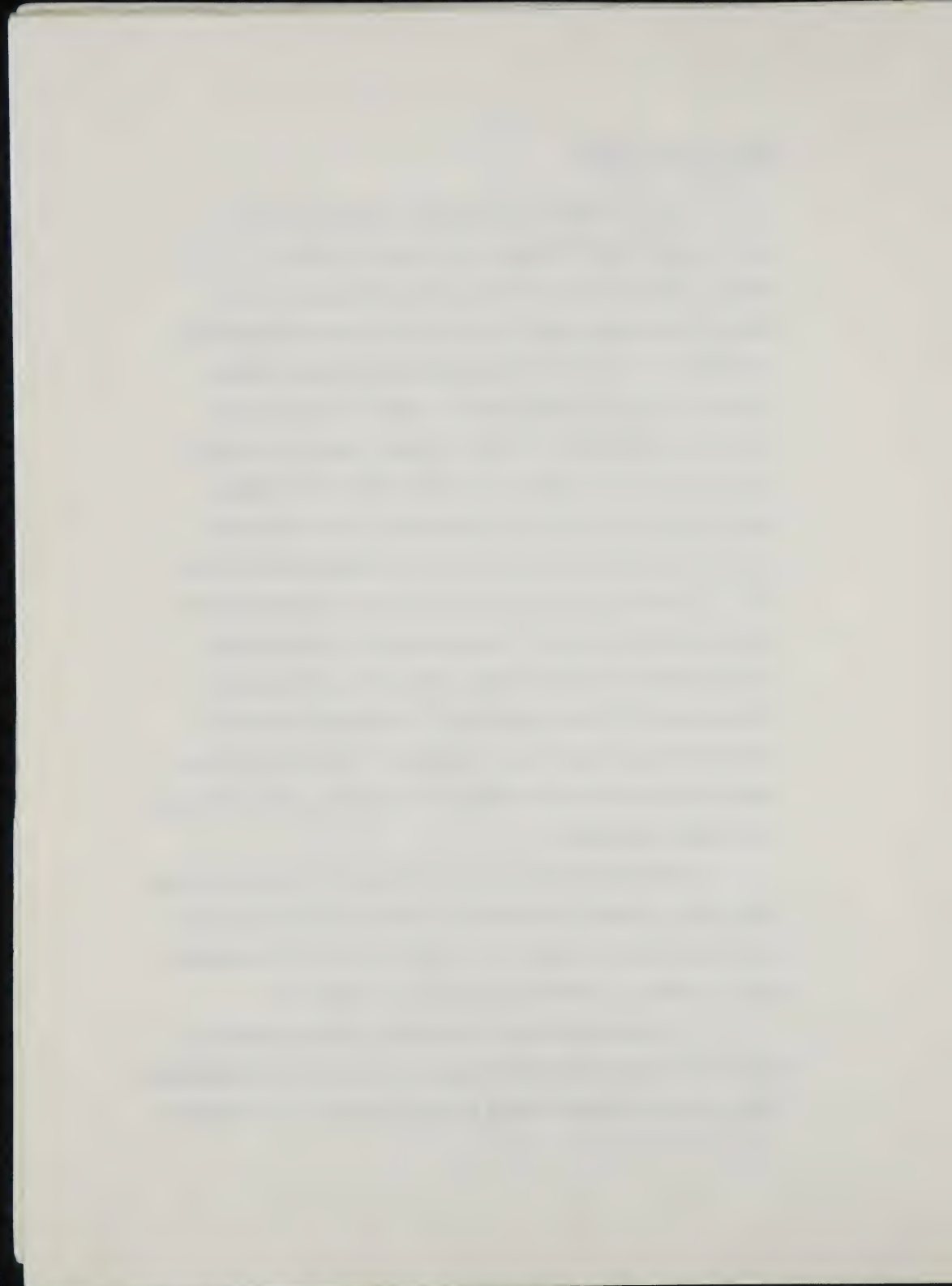


PARTICULARS OF BREAK

Mr. D. Burmey telephoned from the plant to Pipe Line Inspector, Mr. D. Knopp, at his home at 12:30 p.m. Sunday, June 7, 1970 but Mr. Knopp was not at home. Mr. Burmey phoned again about 2:00 p.m. as Mr. Knopp was arriving at his home. Mr. Burmey then mentioned that Great Canadian Oil Sands Limited had experienced a break in its pipe line and that the break was at a short distance south of the plant and near the south boundary of the plant site. Mr. Burmey mentioned that the break had occurred the previous afternoon and that only a small amount of oil was escaping from the pipe line. As to the approximate amount of oil, Mr. Burmey said he could not make an estimate. Appreciating that the location was in a forested area Mr. Knopp asked about notification to the Department of Lands and Forests. Mr. Burmey mentioned it had already been reported and employees of the Forestry section and Wildlife section were already at the location and supervising the cleanup operations.

Regarding the oil that had escaped, Mr. Burmey mentioned that a dike had been constructed confining the escaping oil to an area away from the river. As to the recovery of the escaped oil Mr. Burmey did not think this would be possible.

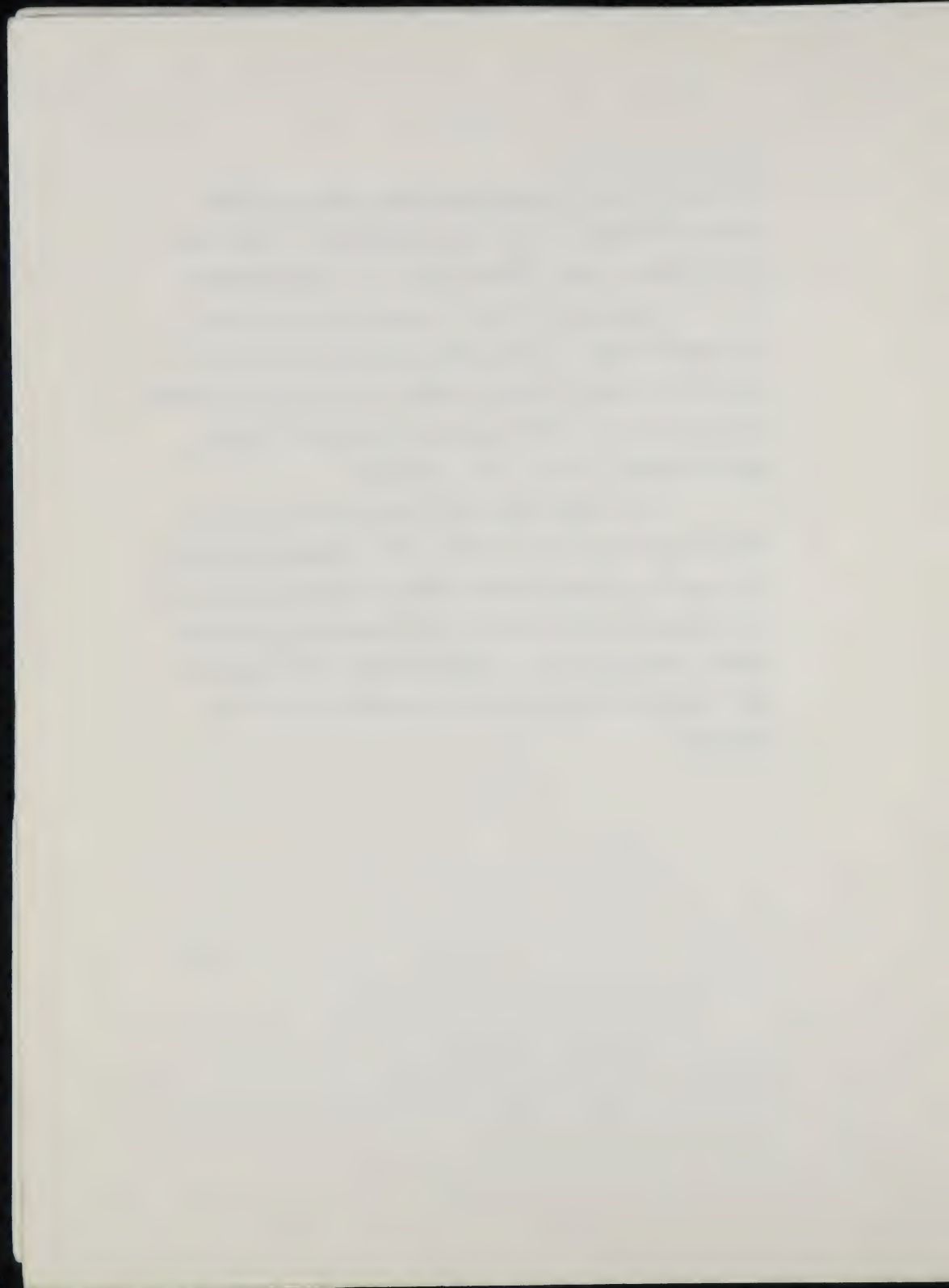
In consultation with the Assistant Superintendent of Pipe Lines it was decided that Pipe Line Inspector, L. Charbonneau, would proceed on Monday morning to the location. Mr. Charbonneau



arrived at 1:00 p.m. finding that repair procedures by the company were under way. The break was located 1.4 miles south of the plant and some 2,000 feet west of the Athabasca River.

A distance of 60 feet on either side of the break was excavated and a 16 foot section containing the fracture was cut out of the pipe line and taken to the company's workshop on the plant site. Following this an additional 44 feet of pipe was removed, being a total of 60 feet.

It was agreed that the 16 foot section of the pipe would be metallurgically inspected. Mr. Charbonneau was satisfied that the cleanup operations that the company had under way in consultation with personnel of the Department of Lands and Forests were appropriate. It seemed unlikely that any of the oil diverted by the dike could be recovered due to its low viscosity.



REPAIR OF THE BREAK

A section of pipe similar in length to the 60 foot section removed from the pipe line was bent in the shop of Canadian Equipment Sales and Service Co. Ltd. (Cessco) to the extent necessary for suitable alinement in the pipe line. The pipe was hydrostatically tested in the Cessco shop to 1800 psig.

The section of pipe was moved to the location and welded into position. The welds were then 100% radiograph inspected and the repairs were completed on June 10th. The air in the line was purged out, filling operations commenced, and the pipe line resumed operations at 11:00 a.m. Inspector Charbonneau was in attendance and the welding, radiographing, repairing and purging were performed to his satisfaction. By 3:30 a.m. on June 11th, the line pressure had stabilized to normal pumping pressure conditions of 1050 psig with two mainline pumps delivering a total flow of 1600 barrels of synthetic crude an hour.

APPENDIX

THE FOLLOWING TABLES GIVE THE RESULTS OF THE ANALYSES OF THE

SAMPLES OF THE VARIOUS TYPES OF WOODS AND OF THE

RESIDUES OF THE DISTILLATION OF THE WOODS.

THE ANALYSES WERE MADE BY THE METHOD OF

THE COMBUSTION OF THE SAMPLES IN A CURRENT OF

OXYGEN, AND THE RESULTS WERE CORRECTED FOR

THE LOSS OF WATER AND OF CARBON DIOXIDE.

THE ANALYSES WERE MADE BY THE METHOD OF

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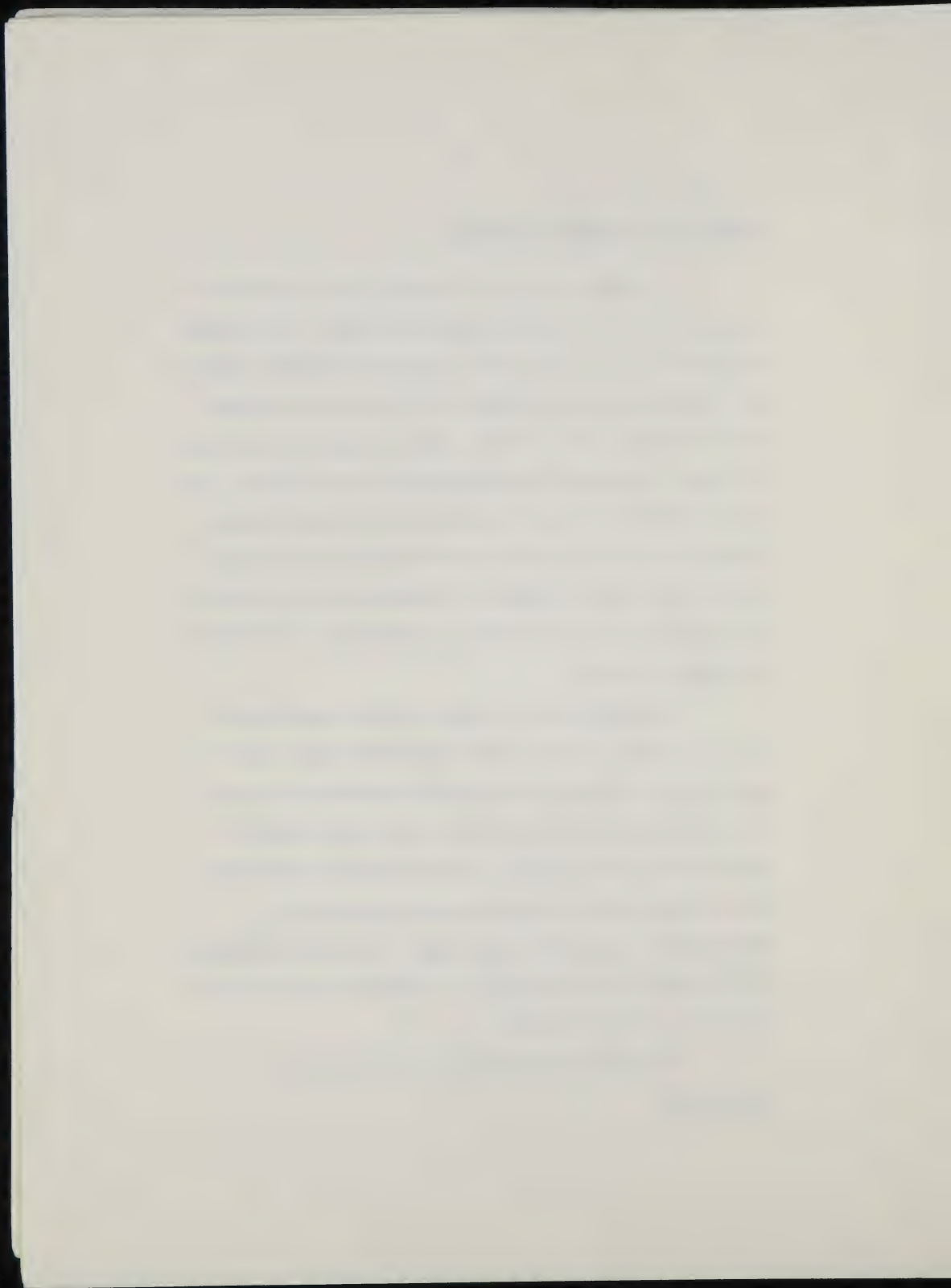
THE LOSS OF WATER AND OF CARBON DIOXIDE.

OBSERVATIONS REGARDING THE BREAK

The break occurred at a wrinkle in a side bend of the pipe where the pipe line changed direction. This wrinkle was approximately 2 inches wide, projected outwards 2 inches from the normal outside diameter of the pipe, and extended some two-thirds of the distance around the pipe, leaving some 17 inches of pipe not directly affected by the wrinkle. The break consisted of a split in the pipe wall longitudinally along the fusion weld of the pipe some 18 inches on either side of the wrinkle, opening to 4 inches wide at the centre. The configuration of the break was therefore in the form of an elongated diamond.

It appeared that the pipe had been hand wrapped after the wrinkle occurred indicating that a final length of pipe had been installed connecting two sections of the pipe line. However the 16 foot section of the pipe involved in the break has been delivered to Hanson Materials Engineering Ltd. for metallurgical inspection and analysis and its investigation is presently continuing. Additional information in this regard and with respect to internal corrosion may be expected in the final report.

The break can be attributed to a defect in construction.





FISH AND WILDLIFE DIVISION
DEPARTMENT OF LANDS AND FORESTS

REPORT ON INVESTIGATIONS OF THE FISH AND WILDLIFE DIVISION
INTO THE G. C. O. S. OIL SPILL
IN THE ATHABASCA RIVER SYSTEM, 1970

M. J. Paetz
Chief Fishery Biologist

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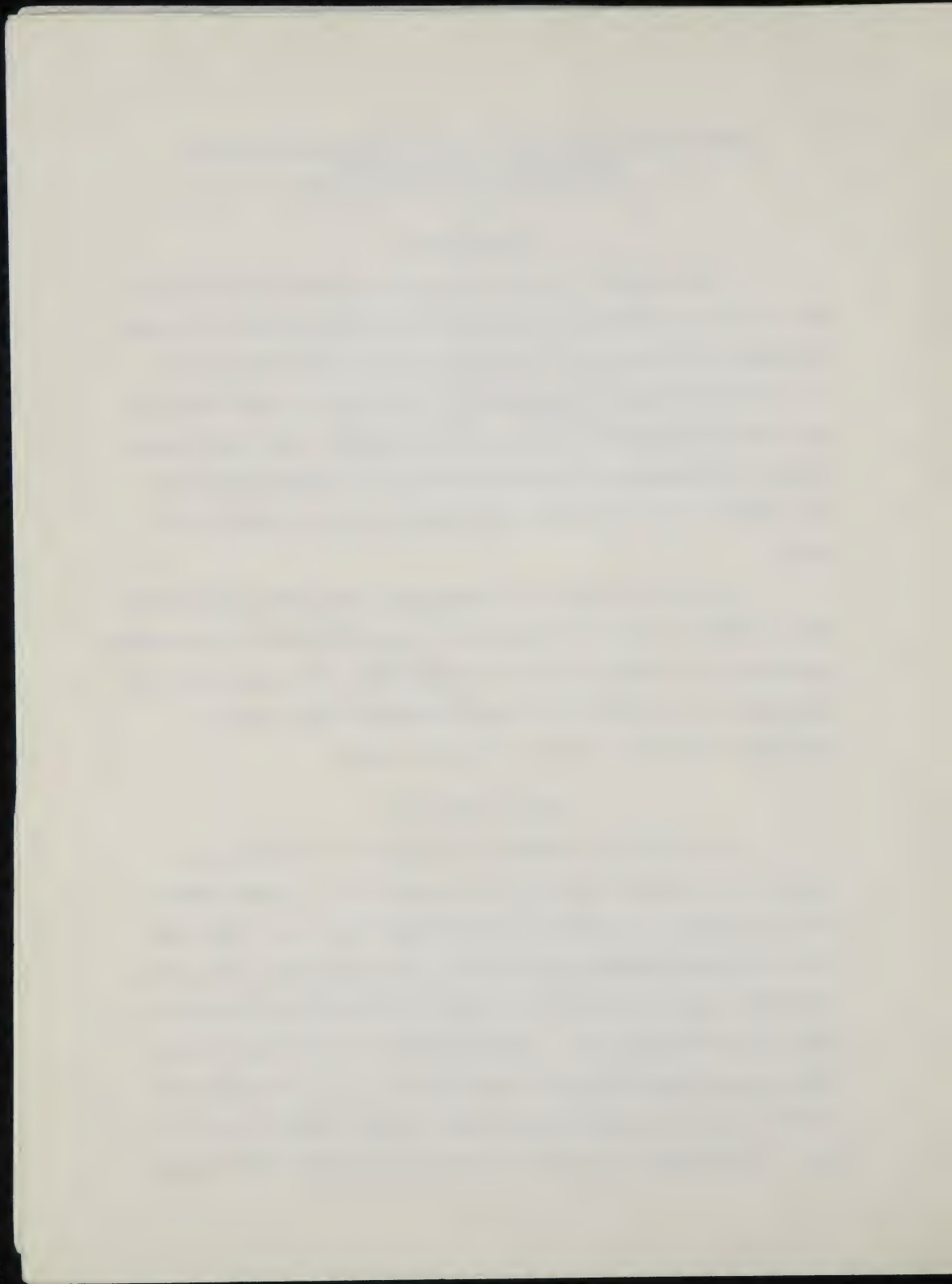
INTRODUCTION

Investigations into the environmental effects of the oil spill into the Athabasca River in the vicinity of the Great Canadian Oil Sands processing plant were carried out during the period June 6th to 19th by the field officer and scientific staff of the Fish and Wildlife Division. The investigations may be placed in three categories: (a) General observations; (b) Sampling of oil-contaminated waters and bioassays; and (c) Sampling of vertebrates and invertebrates in areas exposed to the spill.

During the course of the investigation the writer was associated with a task force which was charged with the responsibility of coordinating investigations, clean-up operations, and publicity. This task force was headed by Dr. D. Stephen of the Canadian Wildlife Service and its activities will be the subject of a separate report.

GENERAL OBSERVATIONS

Fish and Wildlife Officer A. H. Boggs at Fort McMurray was informed of the pipeline break at 9:25 pm, June 6th. He began observations at the site of the break on the morning of June 7th at which time he conferred with personnel of G. C. O. S. and examined the area between the pipeline break and the path over which the oil spillage travelled en route to the Athabasca River. Also observed was the dyke which had been built at approximately 9:00 pm on June 6th by G. C. O. S. to divert the oil from its course toward the river into a holding pond on the G. C. O. S. lease. Officer Boggs noted that at about 6:00 pm on June 7th straw was



placed across the drainage stream which carried the oil spill to the river. This straw boom was located on the stream just above its confluence with the Athabasca River and was designed to trap oil which had contaminated the vegetation and land surface below the point of the diversion of the spill into the holding pond.



FIGURE 1. PIPELINE BREAK.

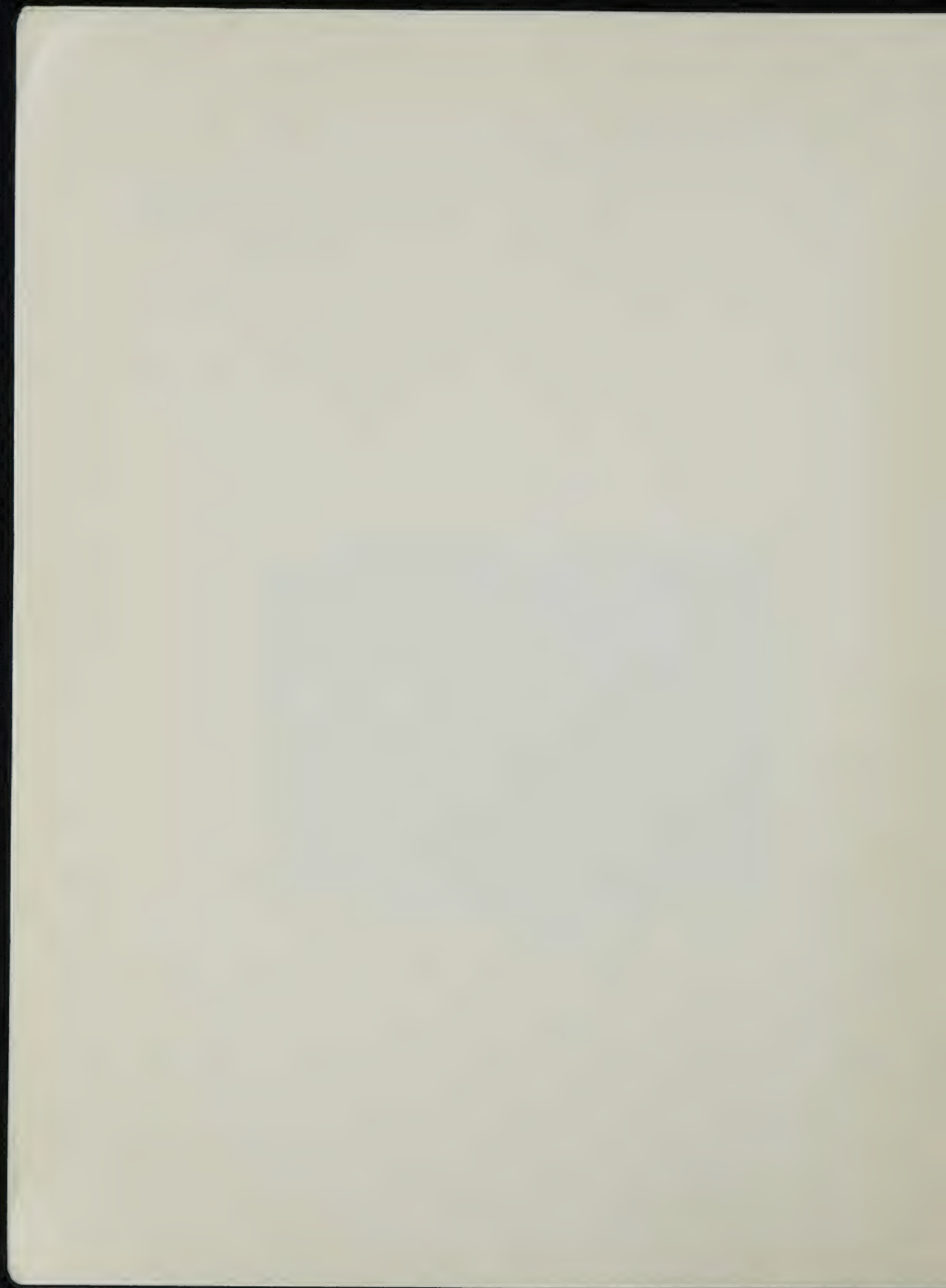




FIGURE 2. POND OF SPILLAGE NEAR PIPELINE BREAK ON PIPELINE RIGHT-OF-WAY.



FIGURE 3. PIPELINE RIGHT-OF-WAY AT POINT OF PIPELINE BREAK. NOTE SPILLAGE TO THE LEFT.





FIGURE 4. DYKE BUILT DIVERTING SPILLAGE.



FIGURE 5. COLLECTION OF SPILLAGE BEING DIVERTED BETWEEN BREAK AND ATHABASCA RIVER.



FIGURE 6. SPILLAGE DIVERTED INTO HOLDING POND.



FIGURE 7. TRIBUTARY OF SPILLAGE NEAR THE RIVER BETWEEN THE DIVERSION AND THE ATHABASCA RIVER.



FIGURE 8. POINT WHERE EFFLUENT ENTERED THE ATHABASCA RIVER. THIS PHOTO WAS TAKEN AFTER THE SPILLAGE WAS DIVERTED.

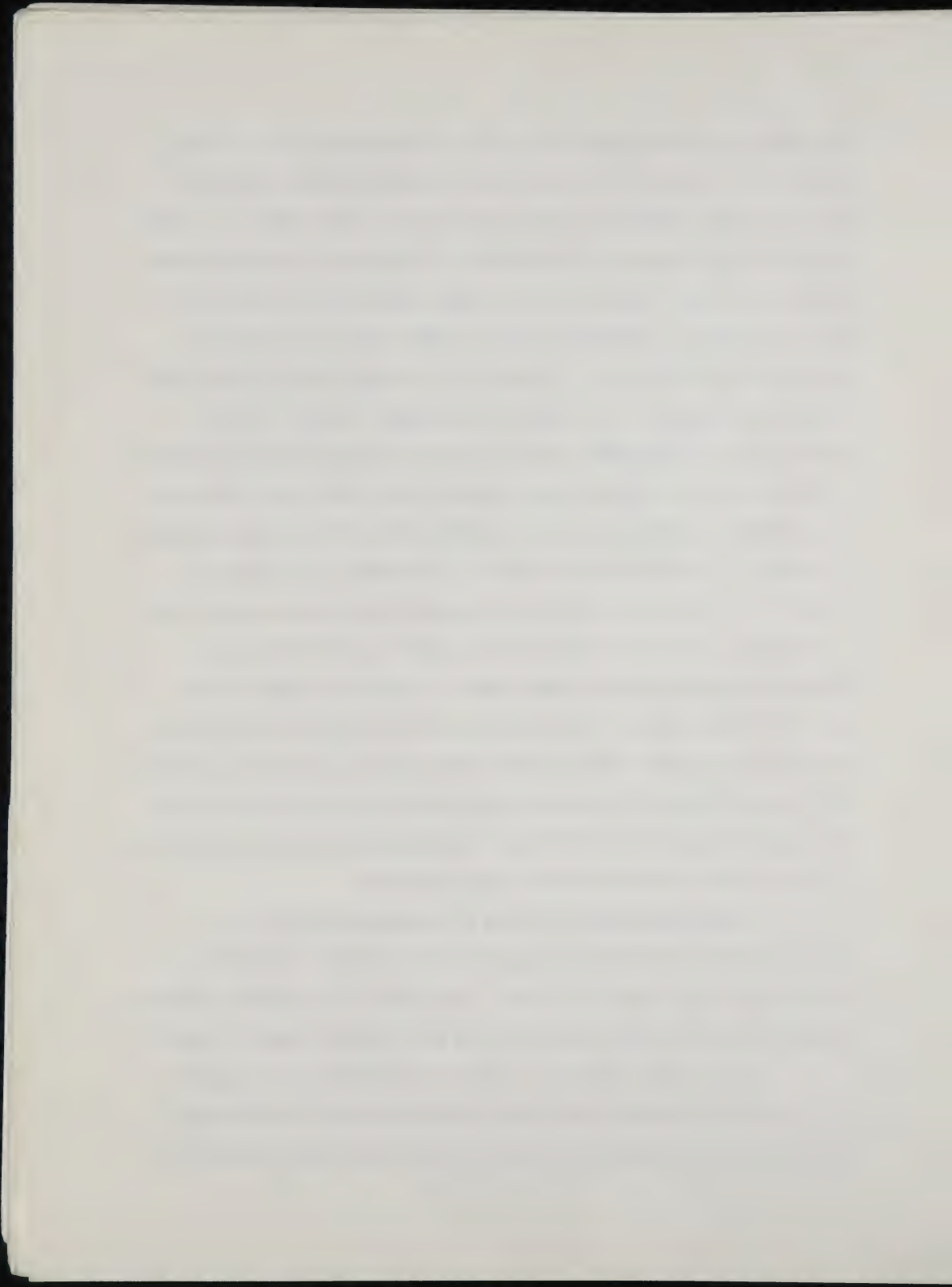
On the afternoon of June 8th and on June 9th and 10th patrols were made down the Athabasca River from Fort McMurray to Embarras Portage and a similar patrol was made by the officer at Fort Chipewyan from the mouth of the Athabasca River upstream to the Indian Reserve #201 F. By June 9th oily material was noted on the surface of the river about five miles above the Embarras River and a yellowish curd-like oil emulsion was observed ten miles above the Embarras ranger station. During the upstream patrol, Officer Schaber noted the presence of ducks on the river below the oil-contaminated area but reported a relative absence of these birds after oil was encountered on the river.

On June 14th the writer accompanied Dr. D. Stephen and Captain Noonan on an aerial patrol of the river and the west end of Lake Athabasca.

The river was observed from an altitude of approximately 300 feet from the G. C. O. S. plant to its mouth as was the delta area and the west portion of Lake Athabasca from Big Point Channel to Fort Chipewyan. After arrival at Fort Chipewyan a float-equipped aircraft was chartered to make aerial and surface inspections of the delta area, Fletcher channel and Big Point Channel. Observations made on these trips were as follows. The river from the G. C. O. S. plant site to Bitumont was relatively free of surface oil slick. If an emulsion was present in this stretch of river, it was not discernible from the aircraft. From Bitumont downstream a surface slick of oil was obvious over the entire river and in the main river channels of the delta area. A portion of Richardson Lake (estimated 25 percent of the lake surface) showed an iridescence indicating the presence of a thin surface oil film. Numerous other ponds and small lakes in the delta area showed no contamination with oil, and there was no evidence of contamination on Mamawi Lake or its outlet channel on this date. All that portion of Lake Athabasca south and west of a line from the mouth of Big Point Channel to Fort Chipewyan was covered with a surface oil film and strings of yellowish emulsion were observed in various areas throughout this portion of the lake. This emulsion was also observed along the north shore of Lake Athabasca at Fort Chipewyan.

Observations made by landing a float-equipped aircraft on Fletcher Channel and Big Point Channel revealed patches of water-oil emulsion and a thin surface oil film. This surface film was more difficult to detect at water level than it was from some distance above the water.

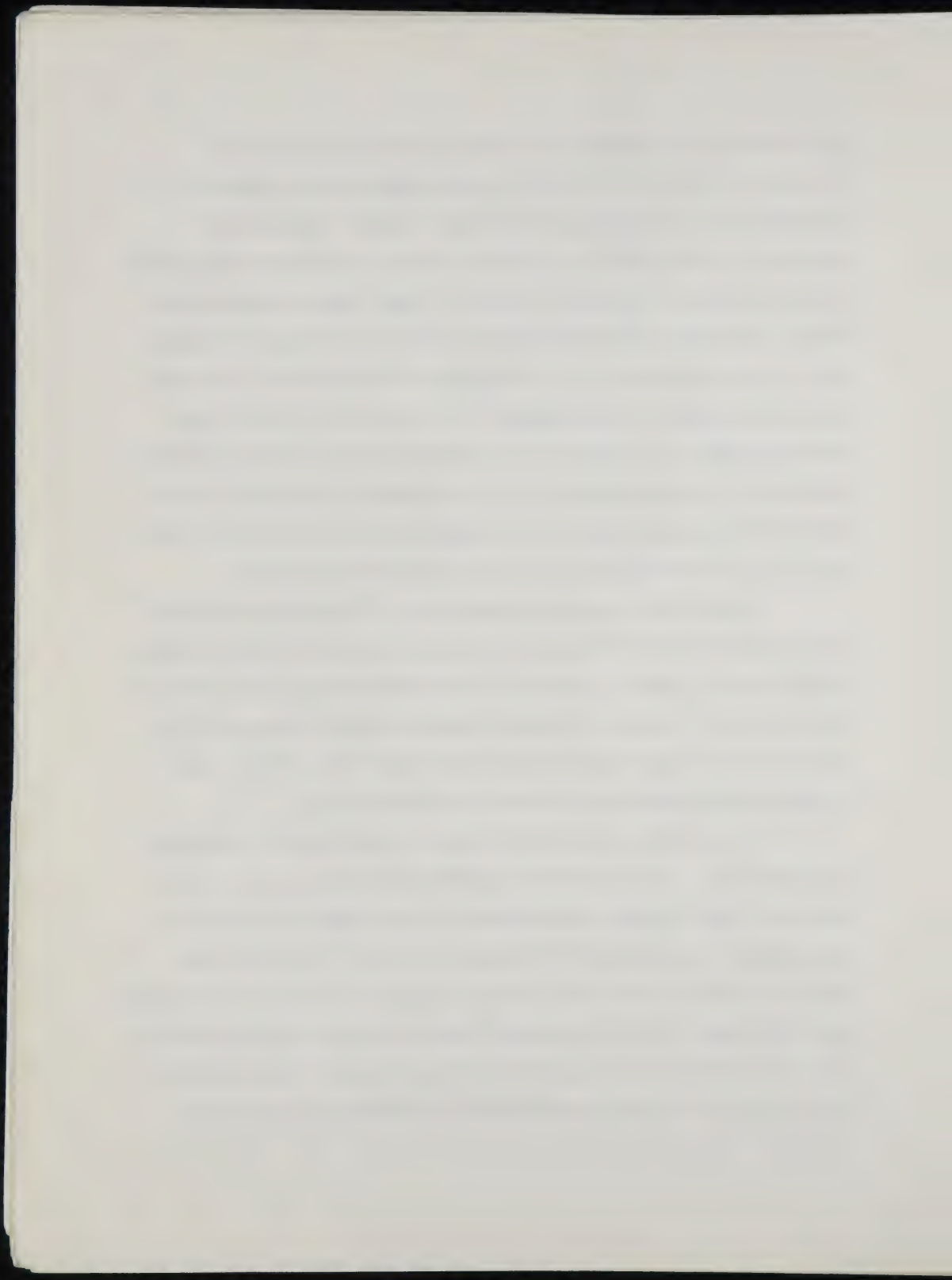
On June 19th and 20th the writer and Officers A. H. Boggs and J. I. Doonanco proceeded by boat from Fort McMurray down the Athabasca River and Big Point Channel and across the west end of Lake Athabasca to



Fort Chipewyan. No evidence of a surface oil film was encountered throughout the entire trip and only on rare occasions could evidence of oil adhering to the mud along the shoreline be noted. Similarly no evidence of an oily film or an emulsion was noted crossing the west portion of Lake Athabasca. It appeared that the oil spill had either been assimilated in some way by the river and lake waters so as to render it undetectable by visual observation or it had passed out of that part of the system and down the outlet of Lake Athabasca. It is the writer's opinion that the disappearance of the spill between June 14th and June 19th was due to a combination of the above factors. It is significant to note that a storm from the west occurred during the intervening period which stirred the lake vigorously and dissipated both the surface film and the emulsion.

On June 20th a patrol was made by Dr. D. Stephen and the writer in a helicopter from Fort Chipewyan, along the north shore of Lake Athabasca to Fidler Point. Again no surface oil film or emulsified oil was evident in the lake waters. However, a yellowish scum-like material was observed in isolated pools of water along the sandy beach just west of Fidler Point. A sample of this material was collected for later analysis.

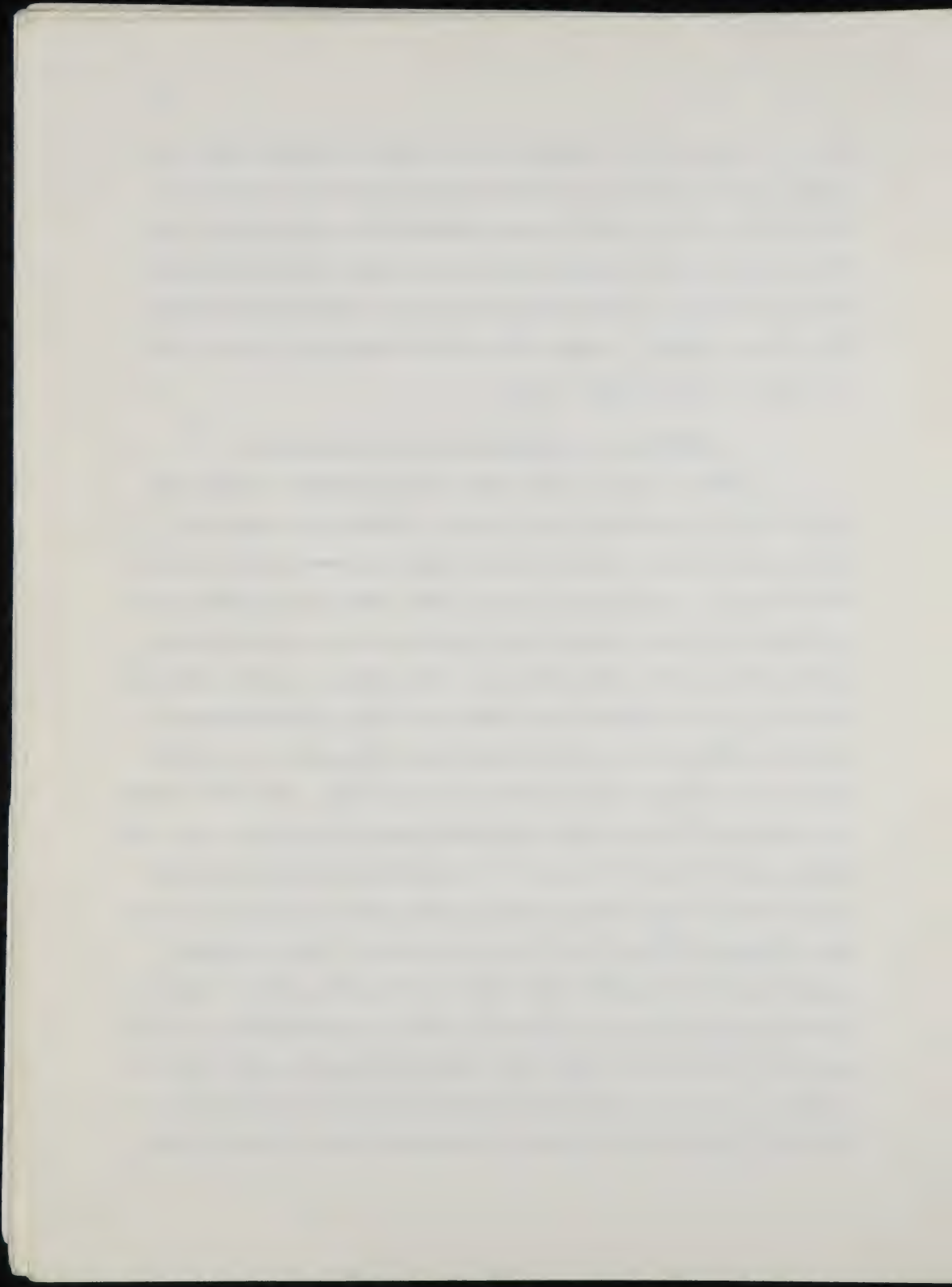
On June 21st a return trip by boat was made from Fort Chipewyan to Fort McMurray. It was noted that the river level had risen some two to three feet since June 19th and navigation was made somewhat hazardous by the presence of large amounts of floating debris, ie., logs, trees, and trash. No evidence of the oil spill was noted until the mouth of the Firebag River was reached. Here an iridescent film was noticed in large patches on the river surface and a strong smell of oil was detected. This condition was encountered at frequent intervals for the remaining distance to the



G. C. O. S. plant site. Examination of the river at the site where the original spill entered revealed that the fresh sign of oil was due to a rise in the river level which caused flooding some low-lying willow flats. This low-lying area had retained significant amounts of the oil spill but it had not entered the river until the level rose and floated the oil out into the main channel. Company officials were immediately advised of the additional oil contamination source.

SAMPLING OF OIL-CONTAMINATED WATER AND BIOASSAYS

Samples of the oil spill were taken for analyses from the site at which the oil entered the river, from the Athabasca River above the spill, and at various intervals from the plant site down to and including Lake Athabasca. The analyses of most of these samples are included in the section of the report prepared by the Division of Environmental Health and do not require further elaboration here. The results of several samples in addition to those contained in the above report are of interest however. A sample of Athabasca River water 200 yards above the point of entry of the spill on June 10th was found to contain 10 mg/l of oil. This would indicate that there is at certain times a significant amount of oil in the river from sources above the site of the spill. The sample of yellowish scum found on June 20th in beach pools just west of Fidler Point on the north shore of Lake Athabasca contained 17 mg/l of oil and grease. This is a greater value than would be expected from sources such as pollen from the adjacent coniferous forest and may be indicative of some oil reaching this area as a result of the strong west winds which occurred during the period June 14th to 19th. It should be noted, however, that this was not a grab sample of water but rather that it represented a collection mainly of the yellowish



material itself which was thus heavily concentrated.

The surface sample taken from the Athabasca River near its junction with the Firebag River on June 21st when a new oil slick was noticed contained 4.2 mg/l of oil and grease. This value is lower than may have been expected considering the oily appearance on the river surface at this point.

Bioassays using rainbow trout as test fish were conducted on the following water samples:

- (1) Water and oil emulsion sample taken June 14th from Fletcher Channel - oil and grease analysis: 323 mg/l.
Result - no deaths in 48 hours.
- (2) Surface sample from Fletcher Channel when oil sheen was noted - oil and grease analysis: 35 mg/l.
Result - no deaths in 48 hours.
- (3) Sample of water and oil emulsion water taken June 14th from area between mouths of Embarras and Fletcher Channels. Oil and grease analysis: 537 mg/l.
Result - 50% mortality in 24 hours, 100% mortality in 48 hours.

In addition to the above, bioassays using rainbow trout were conducted on mixtures of G. C. O. S. oil, water, and two dispersants being used by the company to assist in cleaning up the spill. These dispersants were Corexit 7664 and a substance known as Polycomplex A-11.

Results of the bioassays are shown in the following tables.

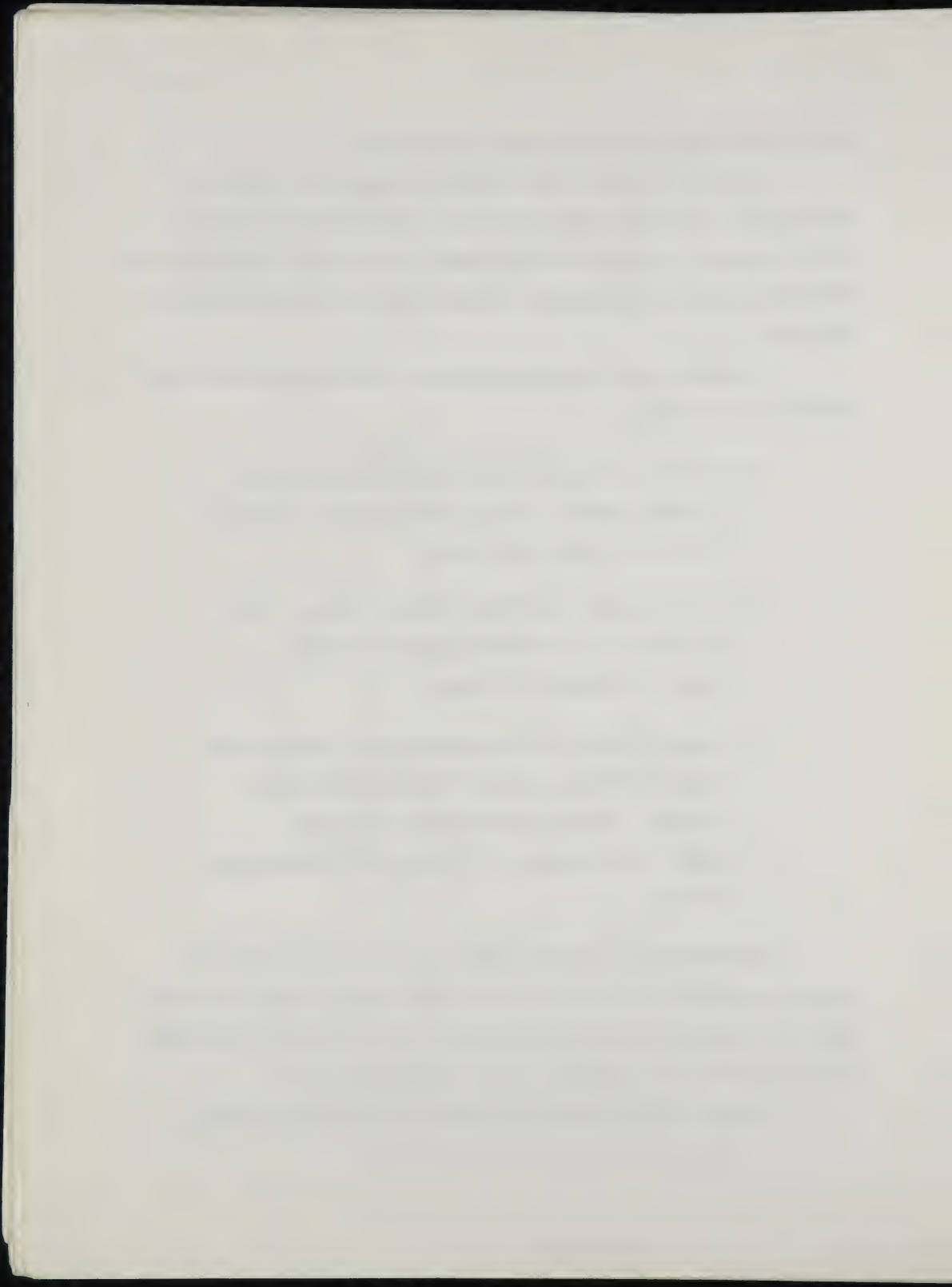


Table I. Bioassay Results on G. C. O. S. Oil.

Concentration	Time	Result
50 mg/l	24 hrs	100% survival
	48 hrs	50% survival
	72 hrs	50% survival
	96 hrs	25% survival
25 mg/l	24 hrs	100% survival
	48 hrs	50% survival
	72 hrs	50% survival

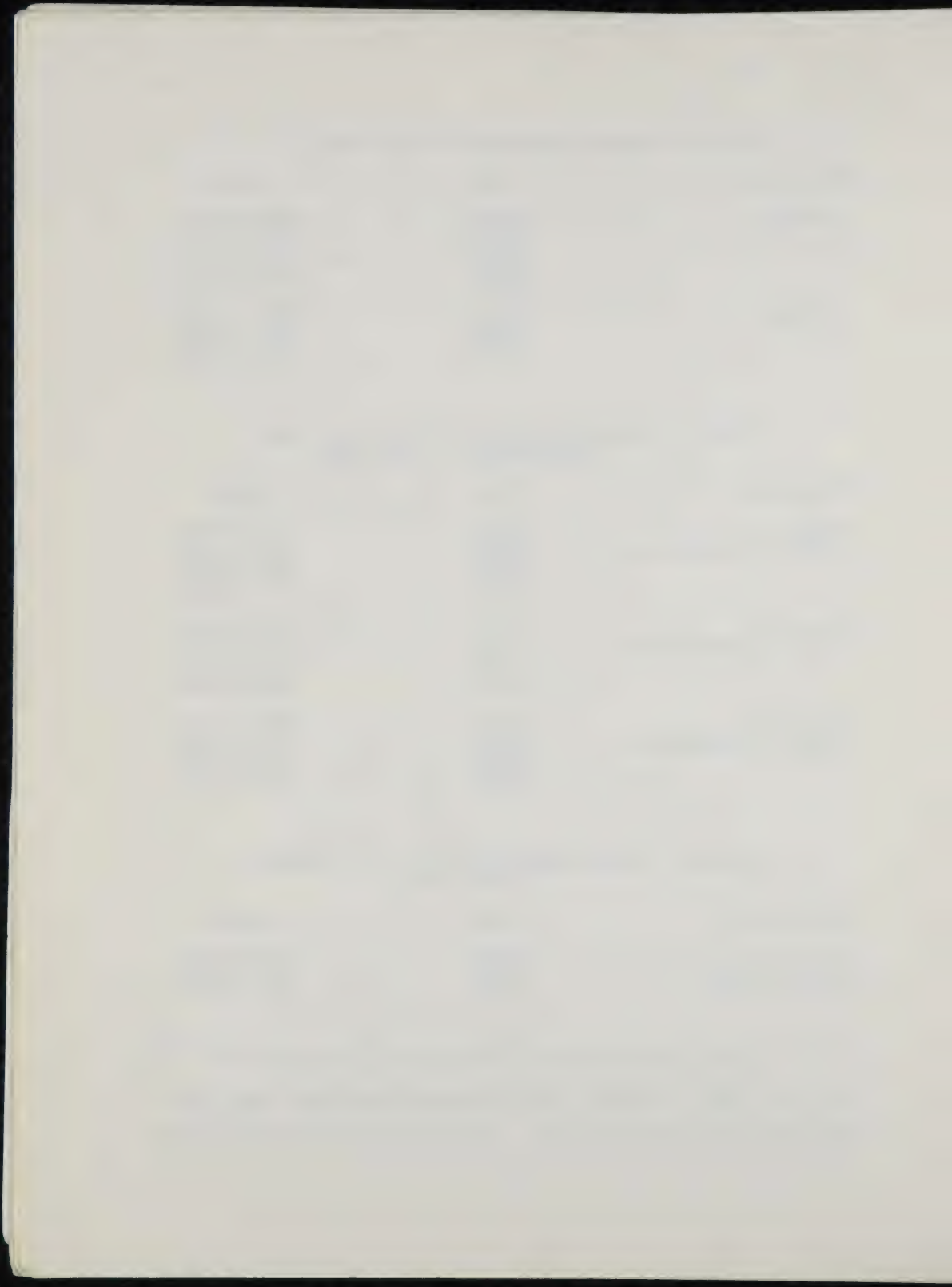
Table II. Bioassay Results on G. C. O. S. Oil plus Polycomplex A-11 (Dispersant)

Concentration	Time	Result
25 mg/l oil	24 hrs	75% survival
2.5 mg/l Polycomplex A-11	48 hrs	50% survival
	72 hrs	25% survival
	96 hrs	0 % survival
25 mg/l oil	24 hrs	25% survival
5 mg/l Polycomplex A-11	48 hrs	25% survival
	72 hrs	0% survival
	96 hrs	0% survival
50 mg/l oil	24 hrs	25% survival
5 mg/l Polycomplex A-11	48 hrs	0% survival
	72 hrs	0% survival
	96 hrs	0% survival

Table III. Bioassay Results on G. C. O. S. Oil plus Corexit 7664

Concentration	Time	Result
25 mg/l oil	24 hrs	50% survival
100 mg/l Corexit	48 hrs	50% survival

These tests indicate that concentrations of 25 mg/l of G. C. O. S. oil can be toxic to fish but that the water-oil emulsions formed in the river were considerably less toxic. It is further indicated where concen-



trations of G. C. O. S. oil of 25 mg/l are reached, Polycomplex A-11 should not be used as a dispersant at the recommended rates of 10:1, oil to dispersant, because of toxicity problems. Insufficient tests were carried out on Corexit 7664 to accurately determine safety levels for fish when using this material as a dispersant. However, it would appear from the tests done that the amount of this product used in treatment of the Athabasca River and Lake Athabasca during the recent spill did not constitute a more serious hazard to fish life than the oil itself.

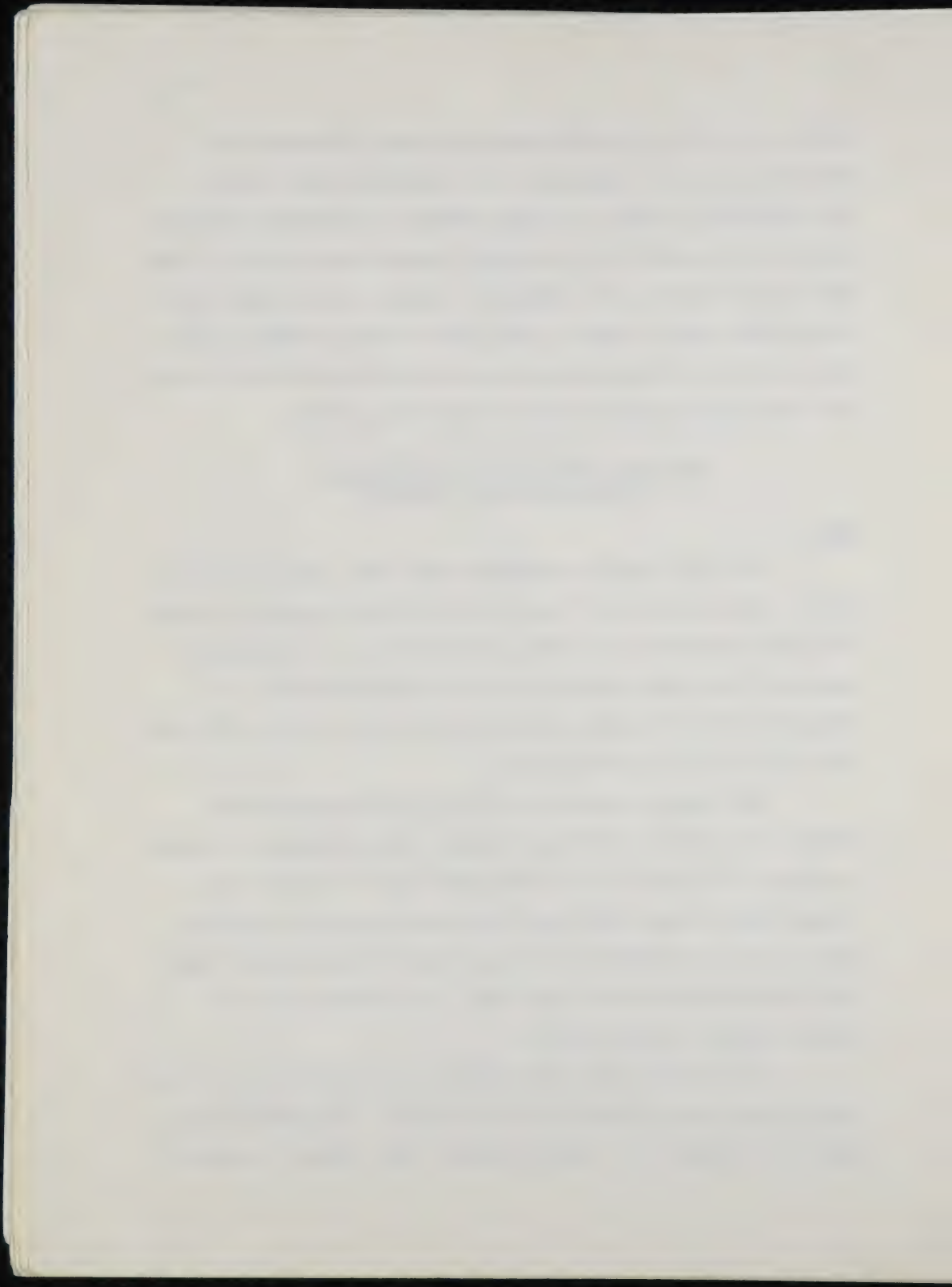
SAMPLING OF VERTEBRATES AND INVERTEBRATES IN AREAS EXPOSED TO THE SPILL

Fish

The chief concerns regarding the fish fauna of the system as a result of the oil spill were: depletion of fish food organisms, mortality of the fish populations and barring actual mortality, the tainting of commercial fish species with an oily flavor in Lake Athabasca. (A commercial fishery for walleye and pike was in progress in the west portion of the lake at the time of the spill.)

With regard to mortality of fish in the river and in Lake Athabasca, no evidence of such was observed. Pike and walleye were caught by angling on June 19th in the Athabasca River near the entry of the Firebag River; walleyes were being taken regularly near Fort Chipewyan between June 17th and 20th; and pike were caught at the junction of Keane Creek and Big Point Channel on June 21st. All specimens taken were examined and were in good condition.

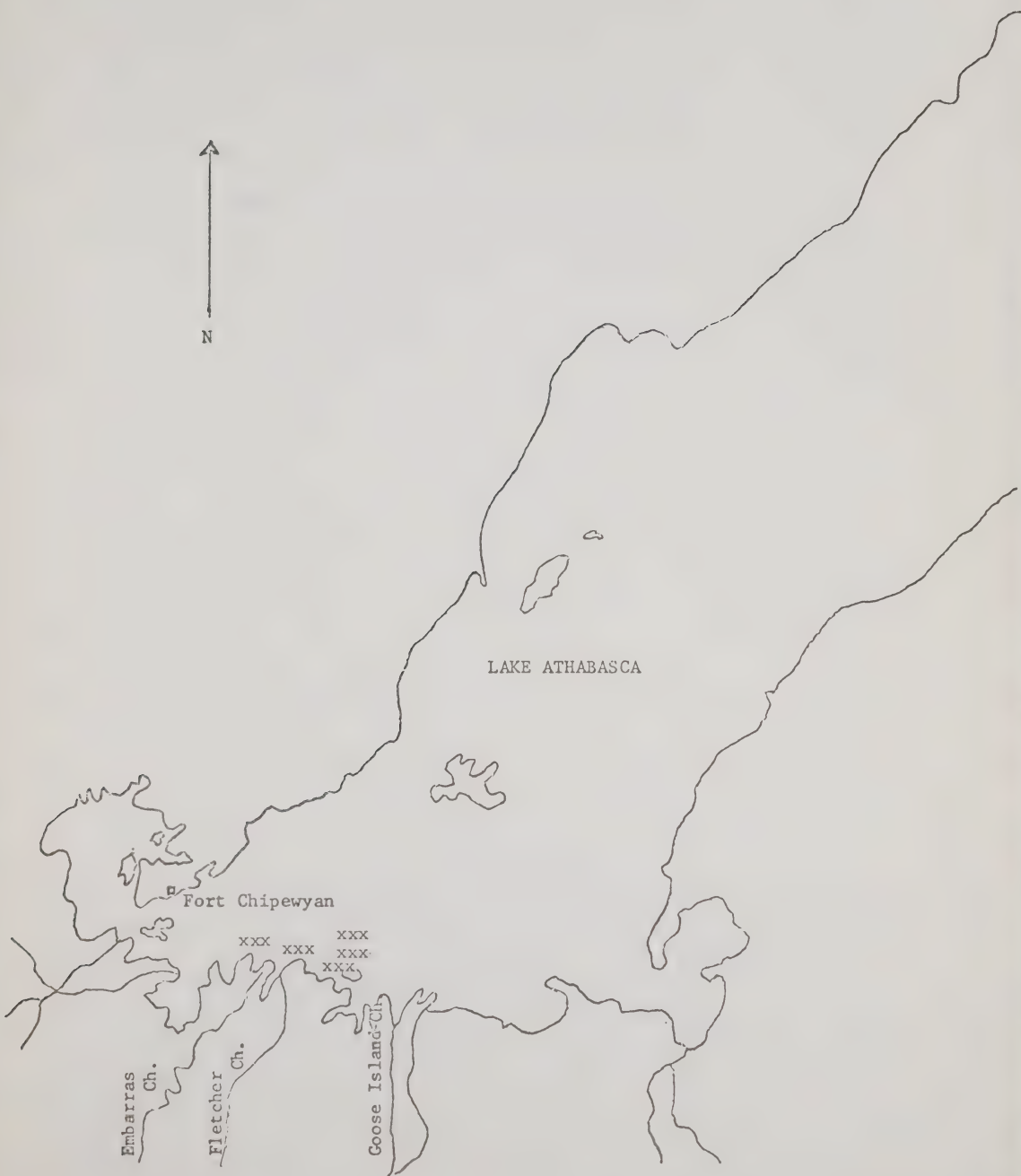
The sampling of fish food organisms was carried out by use of an Ekman dredge during the period June 17th to 20th. All samples were preserved and returned to St. Paul for analyses. The presence or absence of



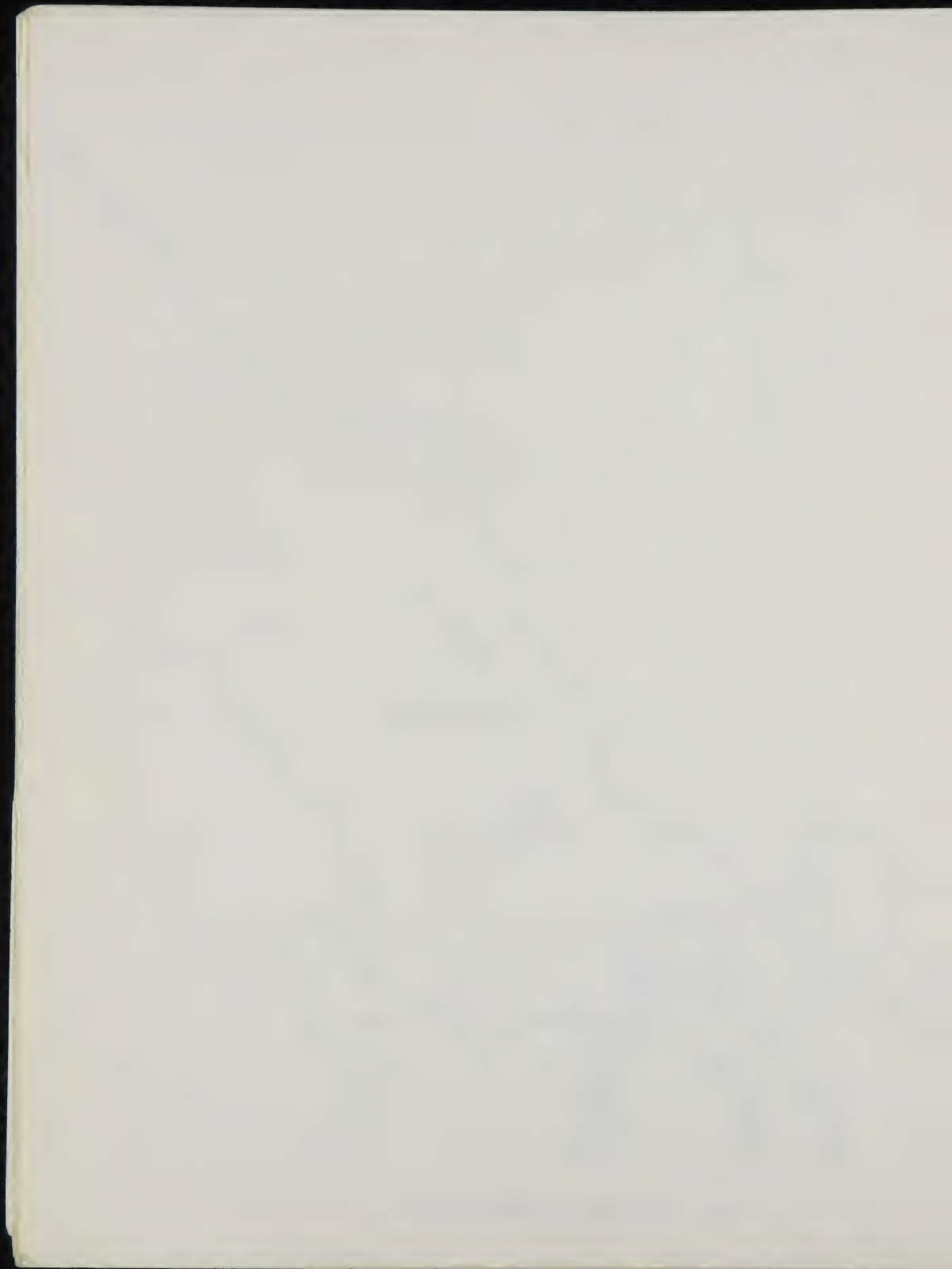
oil in bottom materials was also recorded during analysis. A map showing the locations of samples taken to determine presence of invertebrate animals and the analyses of the samples is presented in Appendix I.

Since no sampling of the invertebrates of the area was carried out prior to the oil spill and since little work of this nature has been done in the area at any time in previous years there is no basis for assessing any change that may or may not have occurred as a result of oil contamination. The presence in some of the samples of certain pollution intolerant organisms such as freshwater shrimps, caddis fly larvae, and to a lesser extent mayfly nymphs, is an encouraging sign which suggests that serious depletion of fish food organisms probably did not occur. However, one cannot state changes in aquatic invertebrate populations did not occur in some areas.

As previously stated, a commercial fishery for walleye and pike was in progress in the area of Lake Athabasca, and was affected by the oil spill. Most of the fishing was being done near the delta area and between Goose Island and Fort Chipewyan. When the oil reached the lake there were complaints of oil adhering to the webbing of gill nets and fears were expressed that the presence of oil in the lake may cause an oily flavor in the fish. Since this flavor, if present, would not be detected until the fish had been shipped to points outside the province, agreement was reached between provincial authorities and the fishermen that commercial fishing would cease until tests could be made to determine whether or not the fish were tainted. Fishing was therefore halted on June 10th and tests were carried out during the week of June 14th to 20th to obtain samples of fish for judging impairment of flavor. The locations of the nets to obtain fish are shown on the accompanying map.



xxx Locations of Fish Sampling



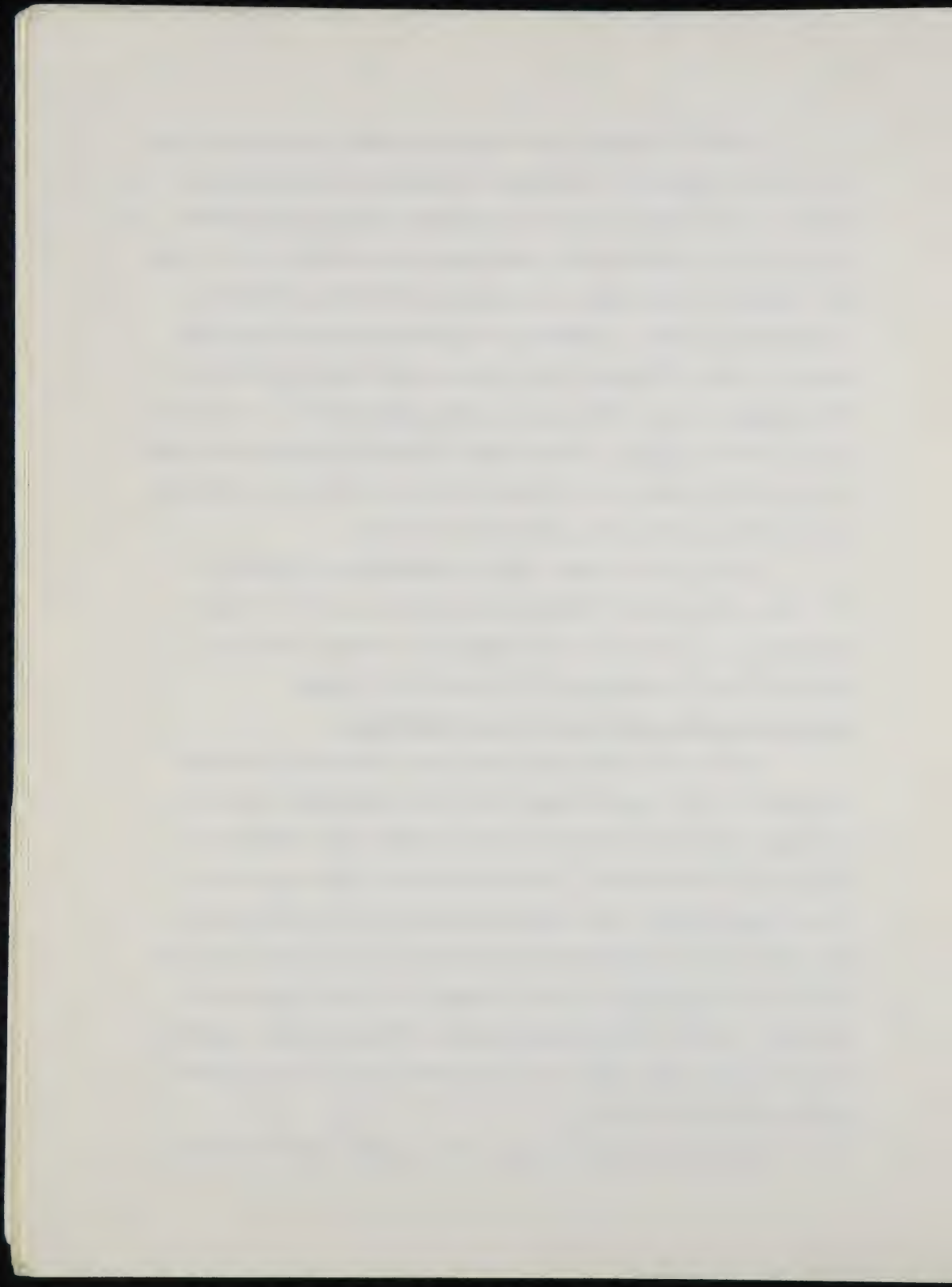
Samples of goldeye, lake whitefish, walleye, and pike were sent to the Canada Department of Fisheries in Winnipeg for flavor judgment. The results of this judging, which was carried out on both raw and cooked portions of the various species, were negative with regard to oily flavor and a message to this effect was telephoned to the Fish and Wildlife Division on June 19th. In addition to the fish forwarded to Winnipeg, samples of walleye obtained on June 20th were taste- and odor-tested at Fort Chipewyan by the writer and four other staff members on the same day as the fish were caught. No oily flavor or odor was detected by the panel. A single walleye taken in the Athabasca River near the Firebag cabin was also declared negative with respect to oil tainting.

On the basis of these tests the fishermen were notified on June 21st that commercial fishing on Lake Athabasca could be resumed immediately. At a later date the length of the fishing season was extended in order to compensate for the period of closure.

Effects on Wildlife other than Fish and Invertebrates

During the various trips made by Fish and Wildlife Division personnel into the area affected by the spill, observations were made to determine whether any waterfowl or aquatic mammals were distressed or killed by oil contamination. On June 8th Officer Boggs obtained one beaver along the bank of the Athabasca River, Sec 13-Twp 94-Rge 11-W 4. This animal was not exhibiting normal behavior and was found, upon being killed, to be covered with an oily substance. No other mammals were reported. A member from the Indian Reserve at the delta area reported to a meeting held in Fort Chipewyan on June 14th that he had not observed any ill effects on muskrats.

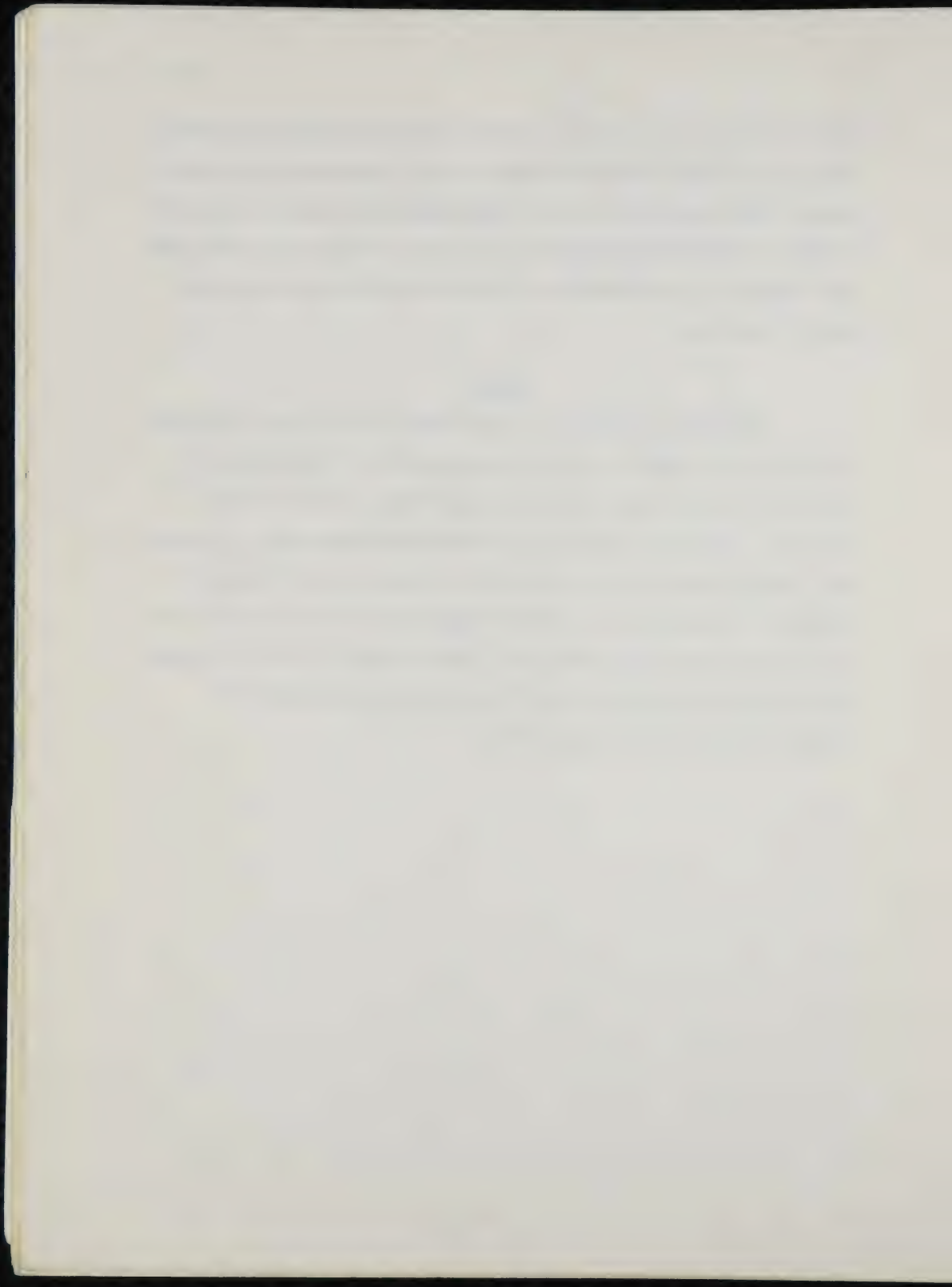
On June 14th Dr. D. Stephen of the Canadian Wildlife Service



and the writer observed several species of ducks, shorebirds, and gulls flying into and away from water areas on which a definite oil sheen was noted. These birds did not at that time appear to be adversely affected. No dead or distressed waterfowl were observed on the downstream trip from Fort McMurray to Fort Chipewyan on June 19th and 20th or on the return trip on June 21st.

SUMMARY

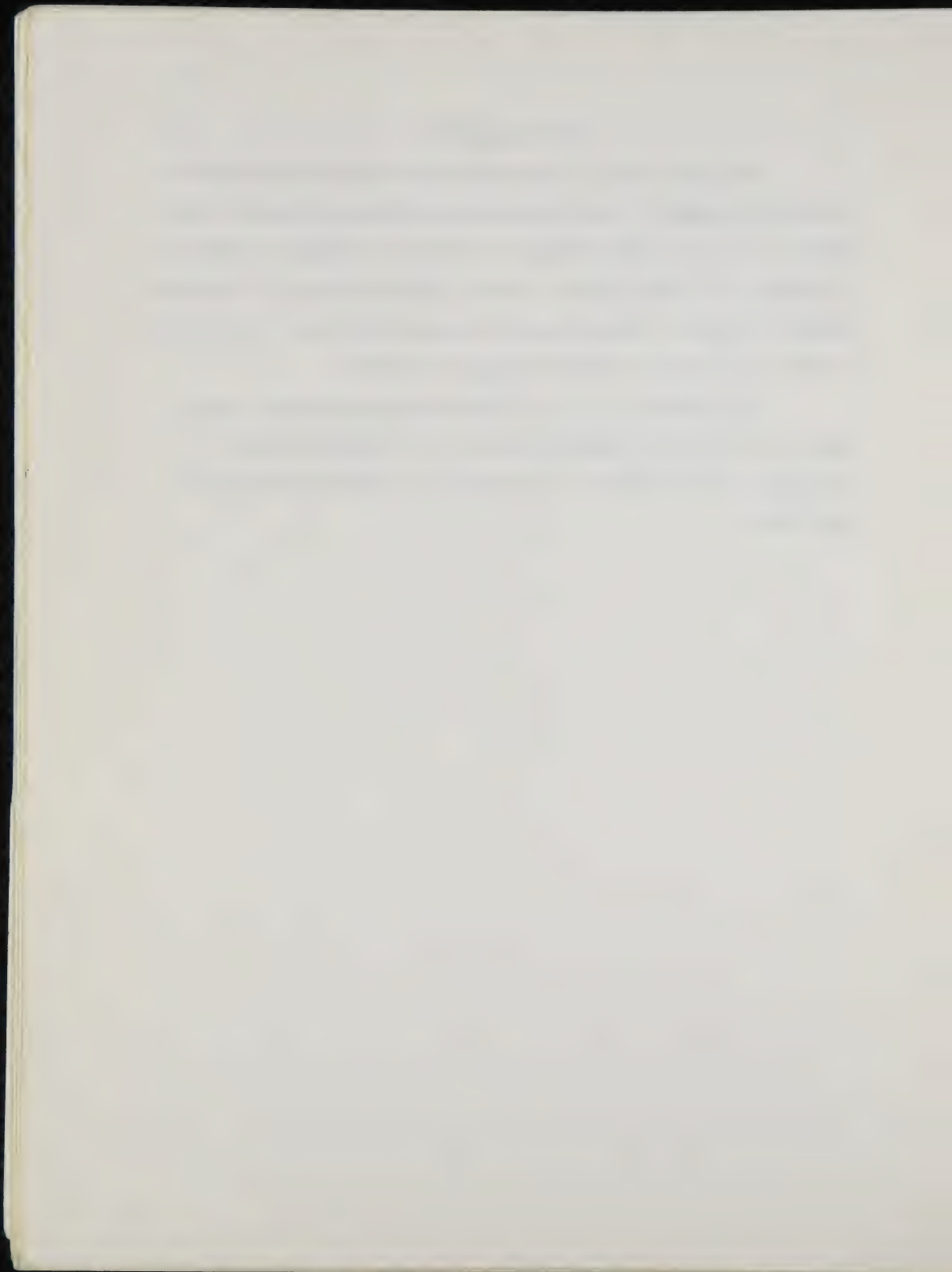
This report outlines the observations and activities undertaken by the Fish and Wildlife Division during the oil spill from the Great Canadian Oil Sands pipeline break into the Athabasca River and Lake Athabasca. While the spill was one of considerable magnitude, it appears that immediate damage to fish and wildlife resources in the area was minimal. A combination of relatively high flows and a heavy silt load in the Athabasca River during and shortly after the spill, and the relatively light, volatile nature of the oil in question probably combined to ameliorate the effects of the spillage.



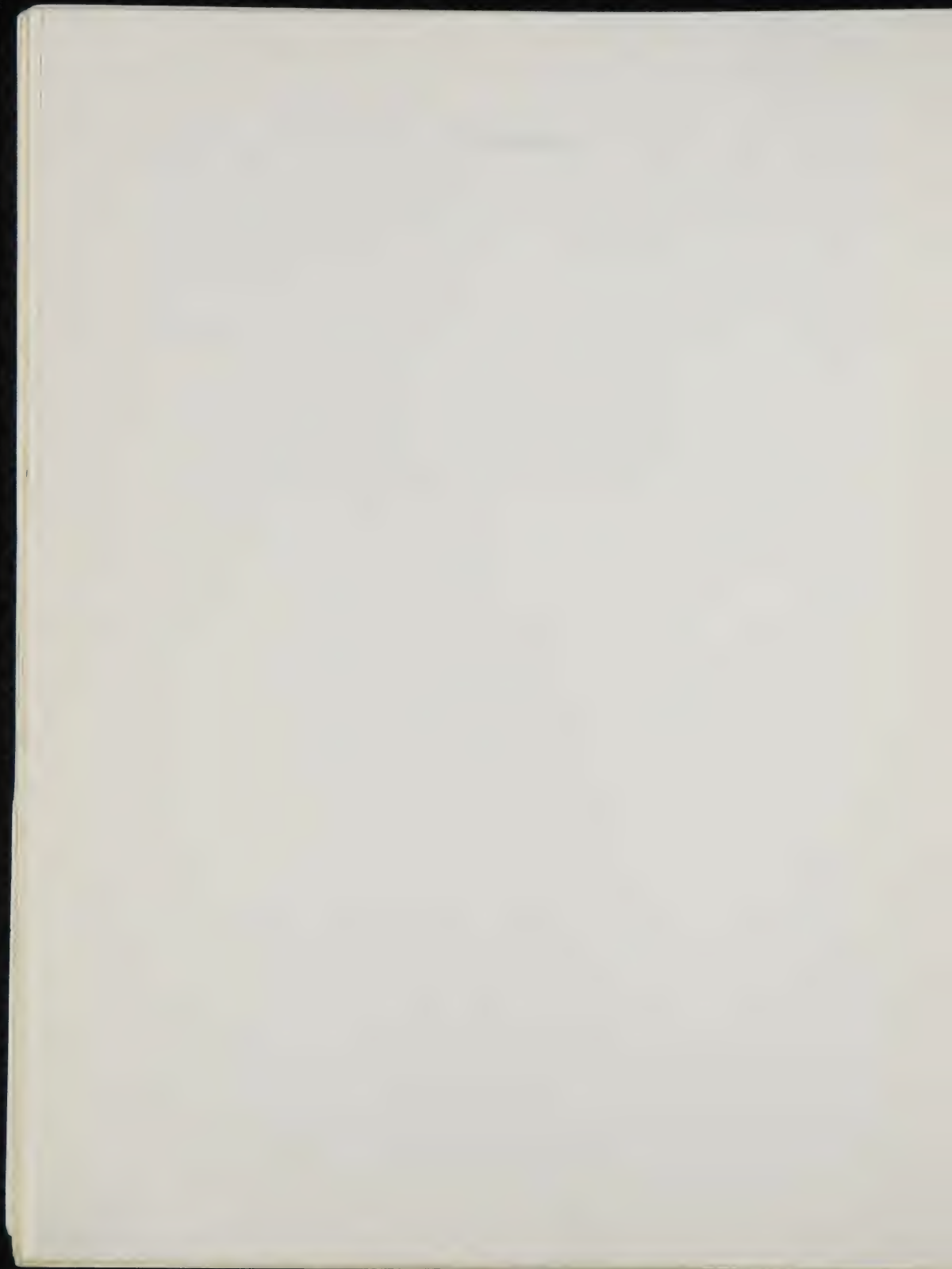
ACKNOWLEDGEMENTS

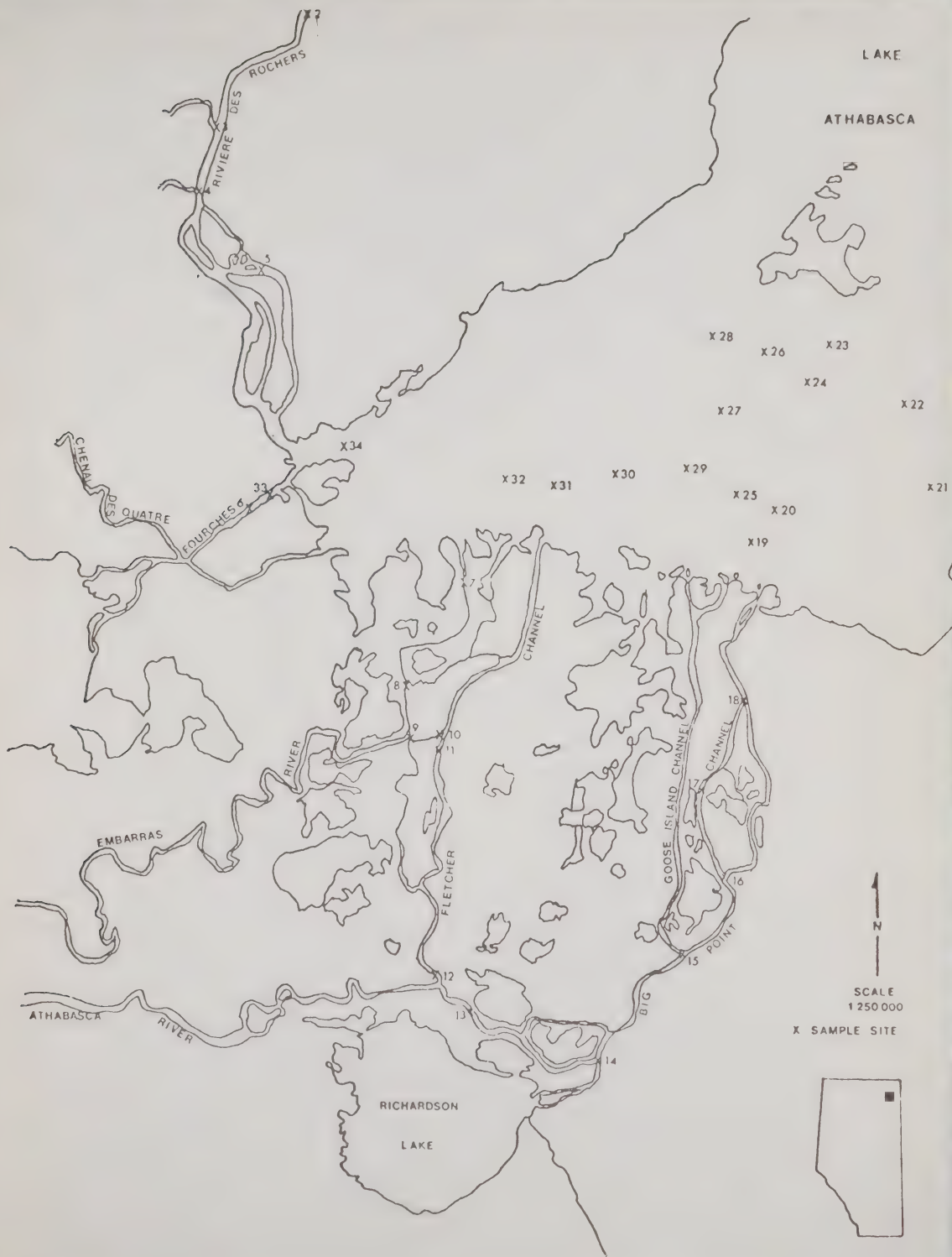
The author wishes to acknowledge the valuable contributions of the following members of the Fish and Wildlife Division during the investigation: Dr. S. B. Smith, Director: Officers A. H. Boggs, E. Schaber, J. Nichols, N. E. Thomas, and C. W. Scott; Regional Officer J. I. Doonanco; Regional Biologists M. Robertson and F. Bishop; Technicians V. Gillman and J. Allen; and Pollution Research Biologist P. Paetkau.

The leadership of Dr. D. Stephen and the assistance of other members of the Canadian Wildlife Service at Fort Chipewyan and the assistance of Mr. R. Gilmour of the Department of Indian Affairs is also acknowledged.



APPENDIX I

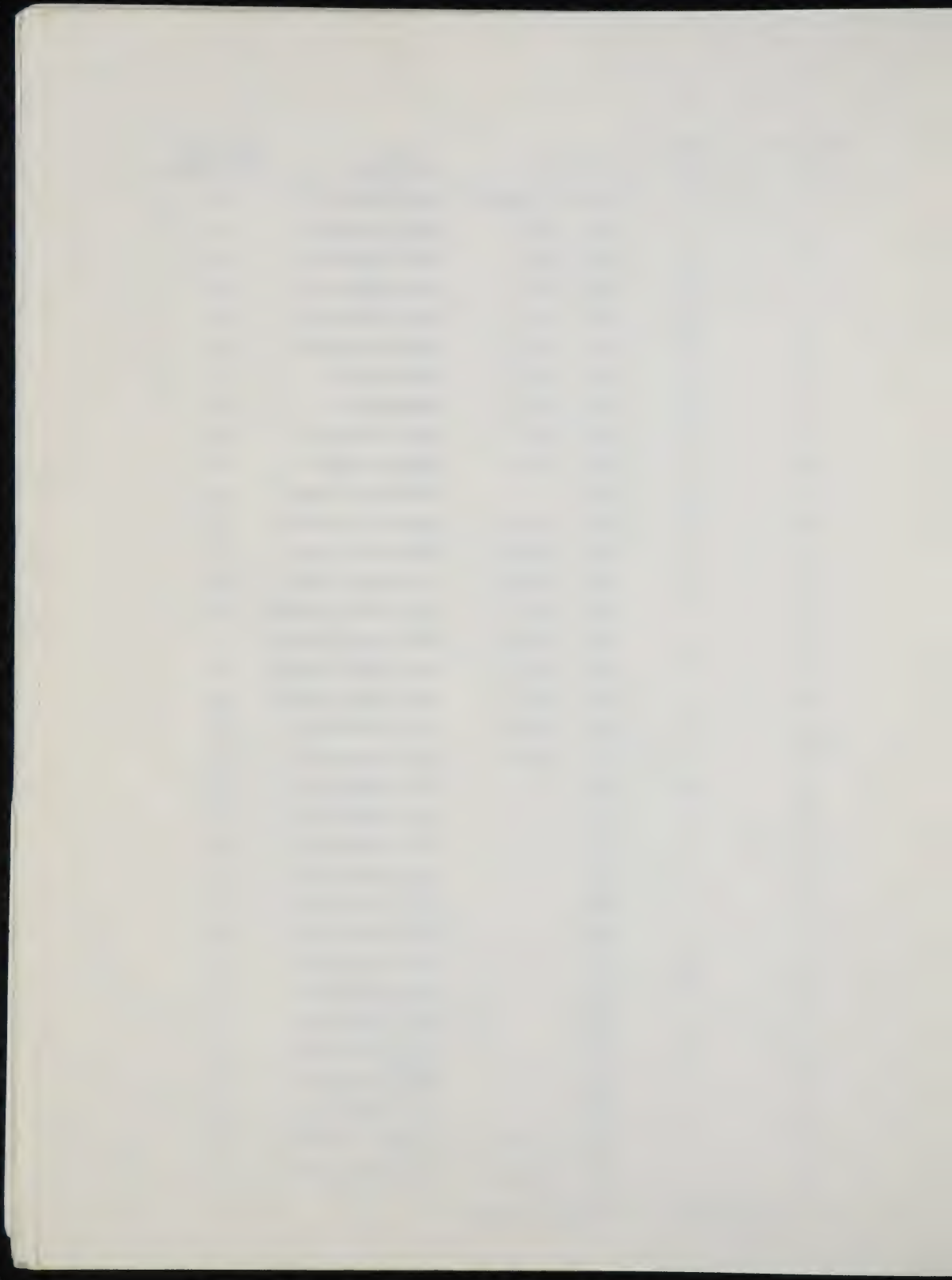




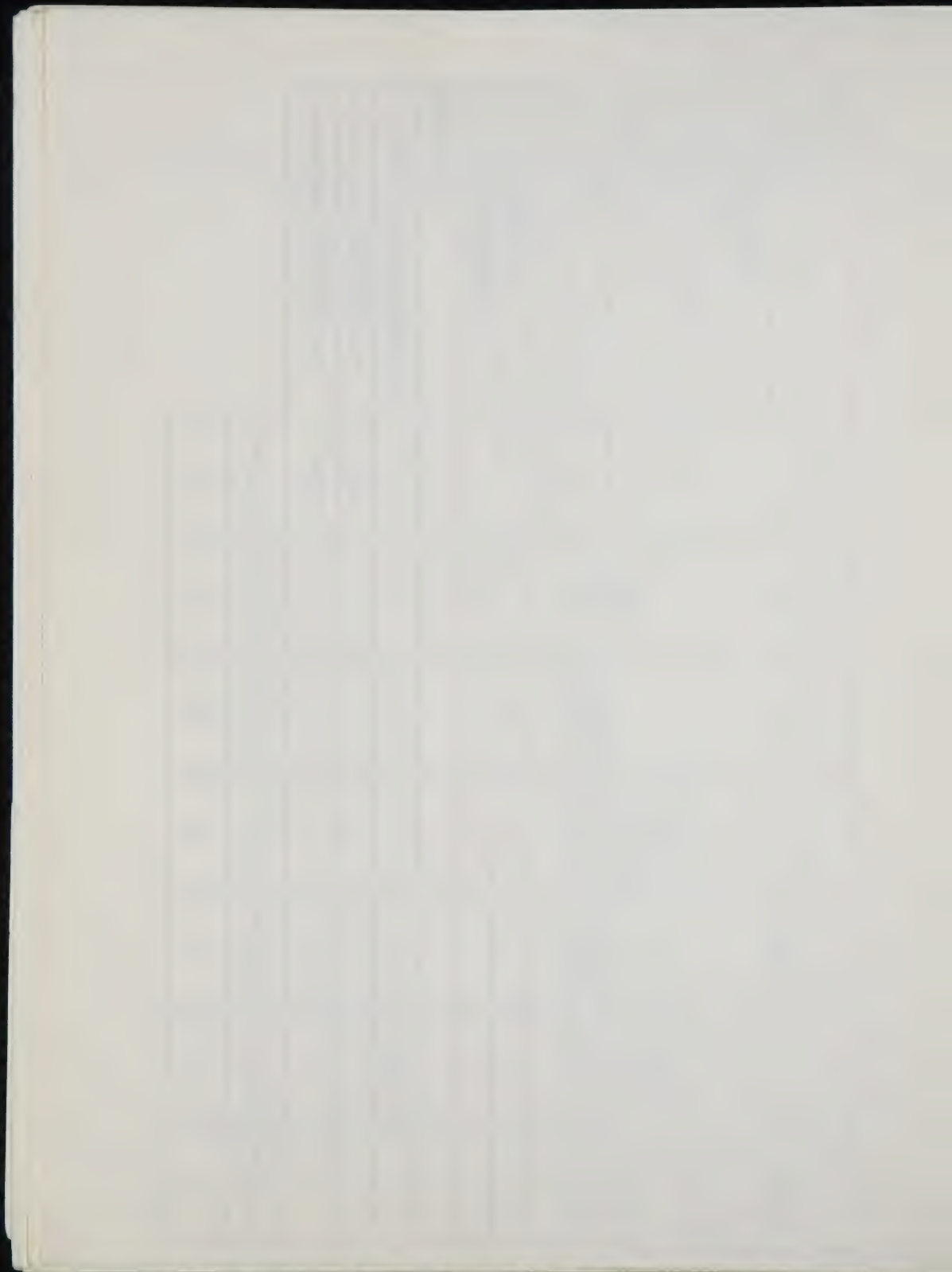
Station No.	Depth Ft.	Substrate	Location	Oil In * Substrate
1	15	Gravel - rubble	des Rochers R.	A
2	3	Sand - silt	des Rochers R.	A
3	8	Sand - silt	des Rochers R.	A
4	5	Sand - silt	des Rochers R.	A
5	4	Sand - silt	des Rochers R.	A
6	5	Sand - silt	Quatre Fourches	P
7	3	Sand - silt	Embarras R.	P
8	5	Sand - silt	Embarras R.	P
9	5	Sand - silt	Canoe Portage	P
10	5	Sand - silt	Canoe Portage	P
11	1	Sand	Fletcher Channel	A
12	10	Sand - debris	Fletcher Channel	P
13	2	Sand - debris	Athabasca River	P
14	4	Sand - debris	Athabasca River	P
15	2	Sand - silt	Big Point Channel**	P
16	4	Sand - debris	Big Point Channel	A
17	5	Sand - silt	Big Point Channel	A
18	6	Sand - silt	Big Point Channel	A
19	12	Sand - silt	Lake Athabasca	A
20	8	Sand - silt	Lake Athabasca	A
21	12	Silt	Lake Athabasca	A
22	10	Silt	Lake Athabasca	A
23	8	Silt	Lake Athabasca	A
24	9	Silt	Lake Athabasca	A
25	8	Silt	Lake Athabasca	A
26	9	Silt	Lake Athabasca	A
27	10	Silt	Lake Athabasca	A
28	8	Silt	Lake Athabasca	A
29	9	Silt	Lake Athabasca	A
30	7	Silt	Lake Athabasca	A
31	9	Silt	Lake Athabasca	A
32	9	Silt	Lake Athabasca	A
33	6	Sand - silt	Quatre Fourches	P
34	8	Silt - debris	Lake Athabasca	A

* P - present; A - absent

** At mouth of Goose Island Channel

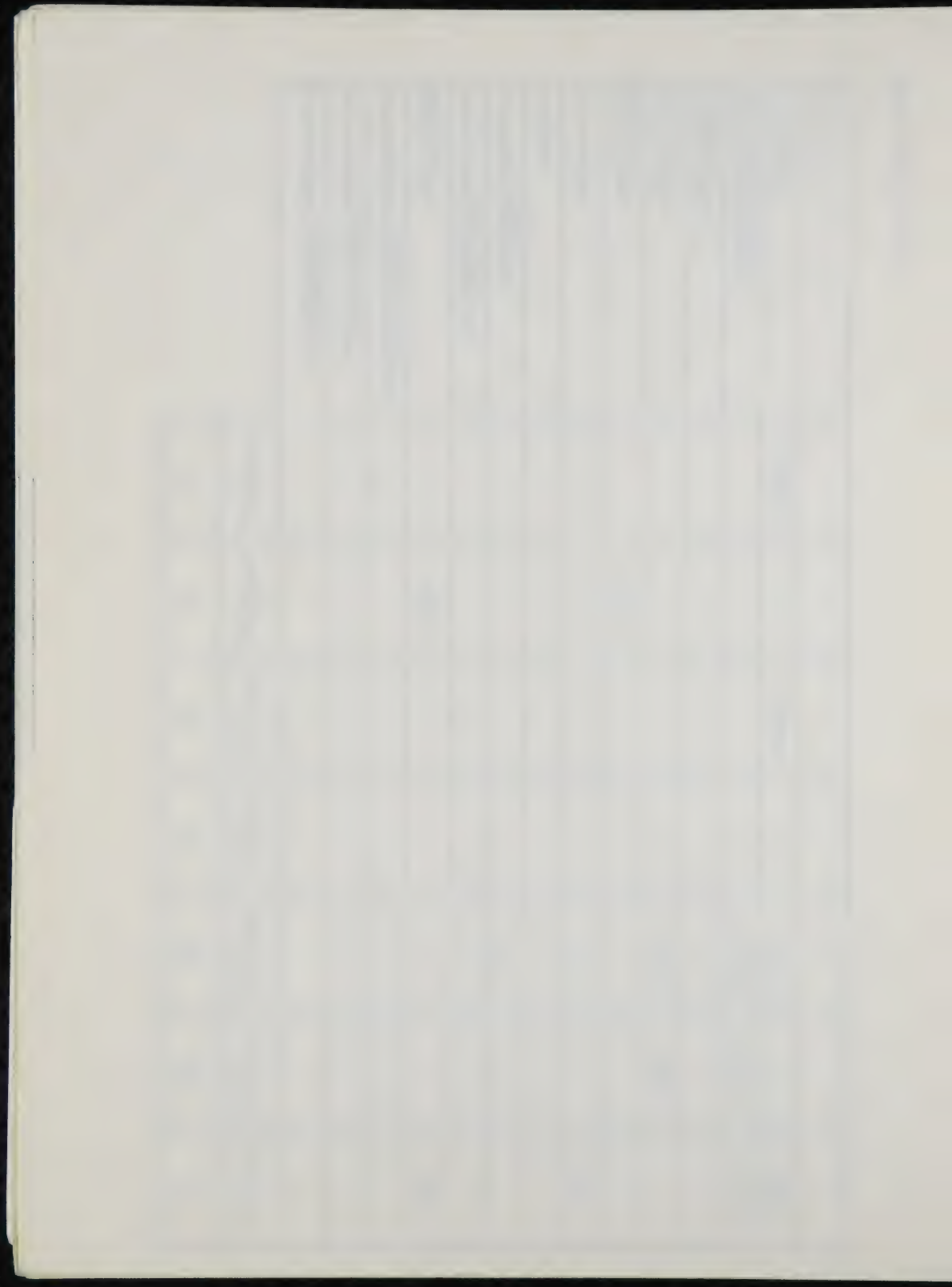


	1	2	3	4	5	6	7
	No. (%) / ft ²	No. (%) / ft ²	No. (%) / ft ²	No. (%) / ft ²	No. (%) / ft ²	No. (%) / ft ²	No. (%) / ft ²
Hydropsychidae: <u>Hydropsyche</u> sp.	36 (94)						
Lepoceridae: <u>Athripsodes</u> sp.	1 (3)						
Psychomyiidae: <u>Polycentropus</u> sp.						1 (20)	
Hexagenia sp.							
Ametropidae: <u>Ametropus</u> sp.							
Baetidae: <u>Baetis</u> sp.							
Corixidae	1 (3)						
Chironomidae		2 (25)	5 (100)	10 (10)	3 (25)	2 (40)	2 (6)
Simuliidae: <u>Simulium</u> sp.		1 (12)		84 (87)		1 (20)	6 (20)
Musculidae: <u>Musculium</u> sp.				2 (2)		1 (20)	
Tanypteroidea: <u>Tanyptera</u> sp.							
Fontinellidae: <u>Fontinella</u> affinis							
Oligochaeta					9 (75)		22 (73)
Fish fry		5 (62)					

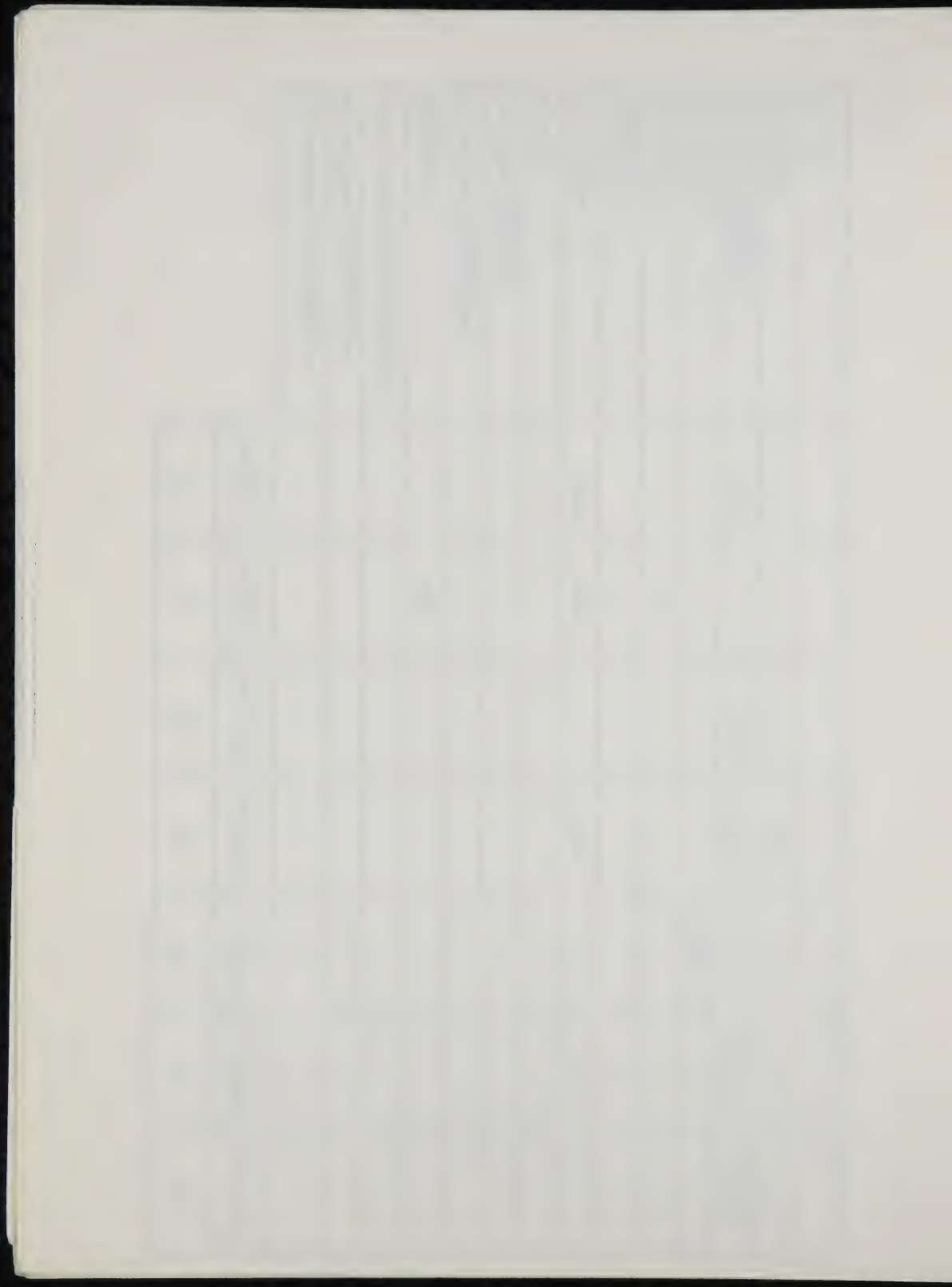


	8	9	10	11	12	13	14
	No. ($\bar{x}$)/ rt^2	No. ($\bar{x}$)/ rt^2	No. ($\bar{x}$)/ rt^2	No. ($\bar{x}$)/ rt^2	No. ($\bar{x}$)/ rt^2	No. ($\bar{x}$)/ rt^2	No. ($\bar{x}$)/ rt^2
Hydropsychidae <u>Hydropsyche</u> sp.							
Leptoceridae: <u>Athripsodes</u> sp.							
Psychomyiidae: <u>Polycentropus</u> sp.	1(5)						
<u>Hexagenia</u> sp.	5(25)						1(1)
Ametropidae: <u>Ametropus</u> sp.			1(100)				
Baetidae: <u>Baetis</u> sp.					1(50)		
Corixidae							
Chironomidae	1(5)	1(5)			1(50)		
<u>Sphaerium</u> sp.							
<u>Musculium</u> sp.							
<u>Lamprolaima</u> sp.							
<u>Pontoporeia affinis</u>							
<u>Oligochaeta</u>	13(65)	16(94)		22(100)		30(100)	96(99)
Fish fry							

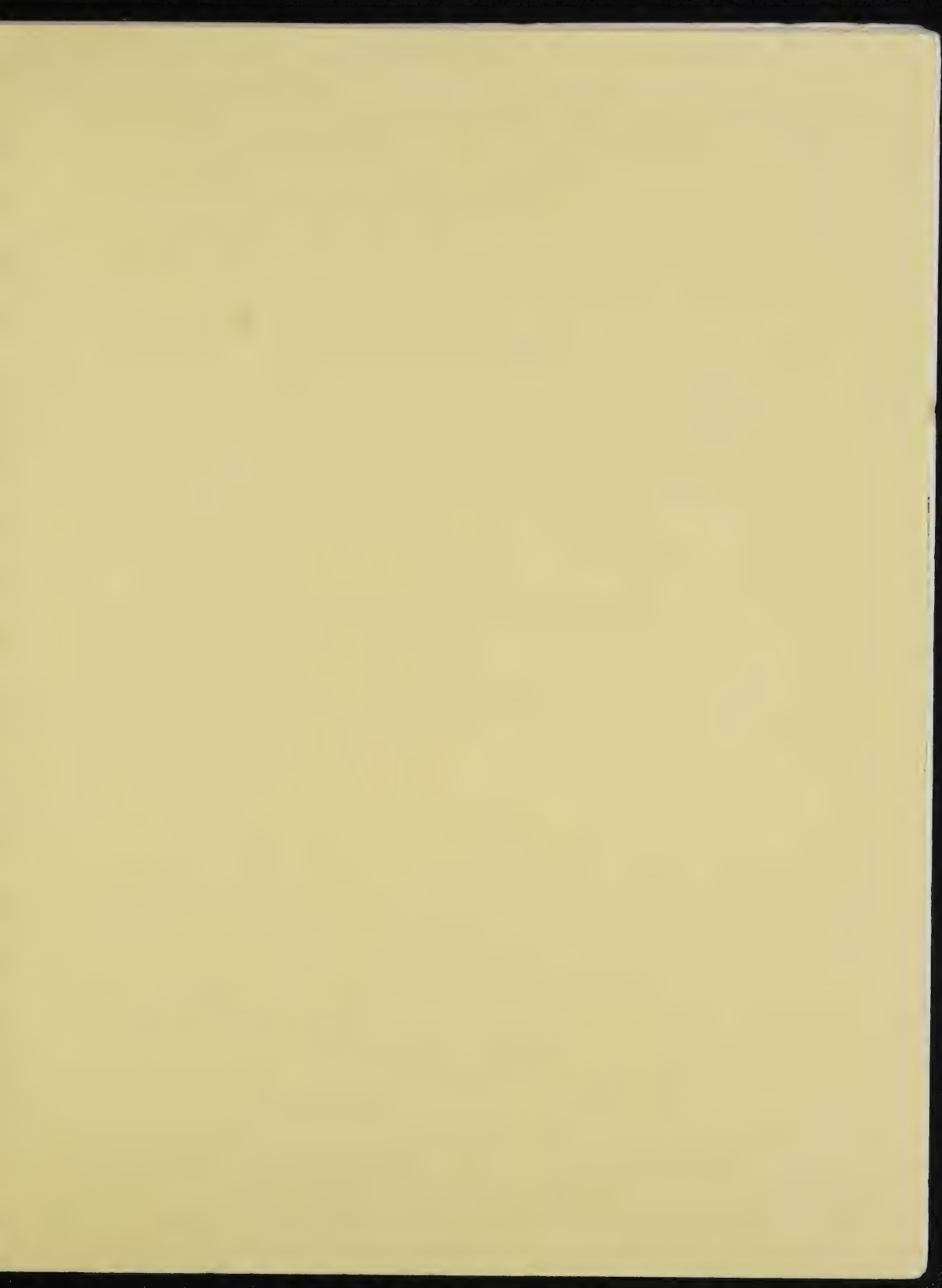
	15	16	17	18	19	20	21
	No. (%) / ft ²	No. (%) / ft ²	No. (%) / ft ²	No. (%) / ft ²	No. (%) / ft ²	No. (%) / ft ²	No. (%) / ft ²
<u>Hydropsychidae</u> <u>Hydropsyche</u> sp.							
<u>Leptoceridae</u> : <u>Athripsodes</u> sp.							
<u>Psychomyiidae</u> : <u>Polycentropus</u> sp.							
<u>Hexagenia</u> sp.		4 (12)					4 (3)
<u>Ametropidae</u> : <u>Ametropus</u> sp.							
<u>Baetidae</u> : <u>Baetis</u> sp.							
<u>Corixidae</u>							
<u>Chironomidae</u>							12 (9)
<u>Sphaerium</u> sp.		29 (88)					
<u>Tusculium</u> sp.					12 (7)	4 (13)	
<u>Lamprolaima</u> sp.							
<u>Pontoporeia</u> <u>affinis</u>					114 (88)	28 (87)	120 (86)
<u>Oligochaeta</u>	2 (100)		12 (100)		8 (5)		4 (3)
Fish fry							



	22	23	24	25	26	27	28
	No. (♂)/ft ²	No. (♂)/ft ²	No. (♂)/ft ²	No. (♂)/ft ²	No. (♂)/ft ²	No. (♂)/ft ²	No. (♂)/ft ²
Hydropsychidae: <u>Hydropsyche</u> sp.							
Leptoceridae: <u>Athripsodes</u> sp.							
Psychomyiidae: <u>Polycentropus</u> sp.							
Hexagenia sp.		4 (25)					
Ametropidae: <u>Ametropus</u> sp.							
Baetidae: <u>Baetis</u> sp.							
Corixidae							
Chironomidae	4 (14)	8 (50)		28 (9)		15 (6)	
Simuliidae: <u>Simulium</u> sp.							
Simuliidae: <u>Simulium</u> sp.		4 (25)					
Simuliidae: <u>Simulium</u> sp.					4 (50)		
Pontoporeia: <u>affinis</u>	24 (86)		52 (100)	272 (89)	4 (50)	236 (94)	8 (100)
Oligochaeta				4 (1)			
Fish fry							



	29	30	31	32	33	34
	No. (♂)/ft ²	No. (♂)/ft ²	No. (♂)/ft ²	No. (♂)/ft ²	No. (♂)/ft ²	No. (♂)/ft ²
Hydropschidae <u>Hydropsyche</u> sp.						
Leptoceridae: <u>Atthripsodes</u> sp.						
Psychomyiidae: <u>Polycentropus</u> sp.						
<u>Hexagenia</u> sp.						
Ameletopidae: <u>Ameletopus</u> sp.						
Baetidae: <u>Baetis</u> sp.						
Corixidae						
Chironomidae	4(2)			8(4)		12(43)
<u>Sphaerium</u> sp.						
<u>Musculium</u> sp.						
<u>Lamprolaima</u> sp.						
Portonoreia <u>affinis</u>	220(96)	148(100)	192(100)	172(92)		
Oligochaeta	4(2)			8(4)	16(100)	16(57)
Fish Dry						



WATER RESOURCES DIVISION

REPORT REGARDING OIL PIPELINE RUPTURE

GREAT CANADIAN OIL SANDS LTD.

R. E. BAILEY, P. ENG.

DIRECTOR OF WATER RESOURCES

GREAT CANADIAN OIL SANDS LTD.

OIL PIPELINE RUPTURE

AND

ATHABASCA RIVER

Activity

The Water Resources Division did not take an active part in the investigations and "clean-up" operations arising out of the Great Canadian Oil Sand oil pipeline break and ensuing oil spill into the Athabasca River, other than to be prepared to lend assistance if called upon to do so.

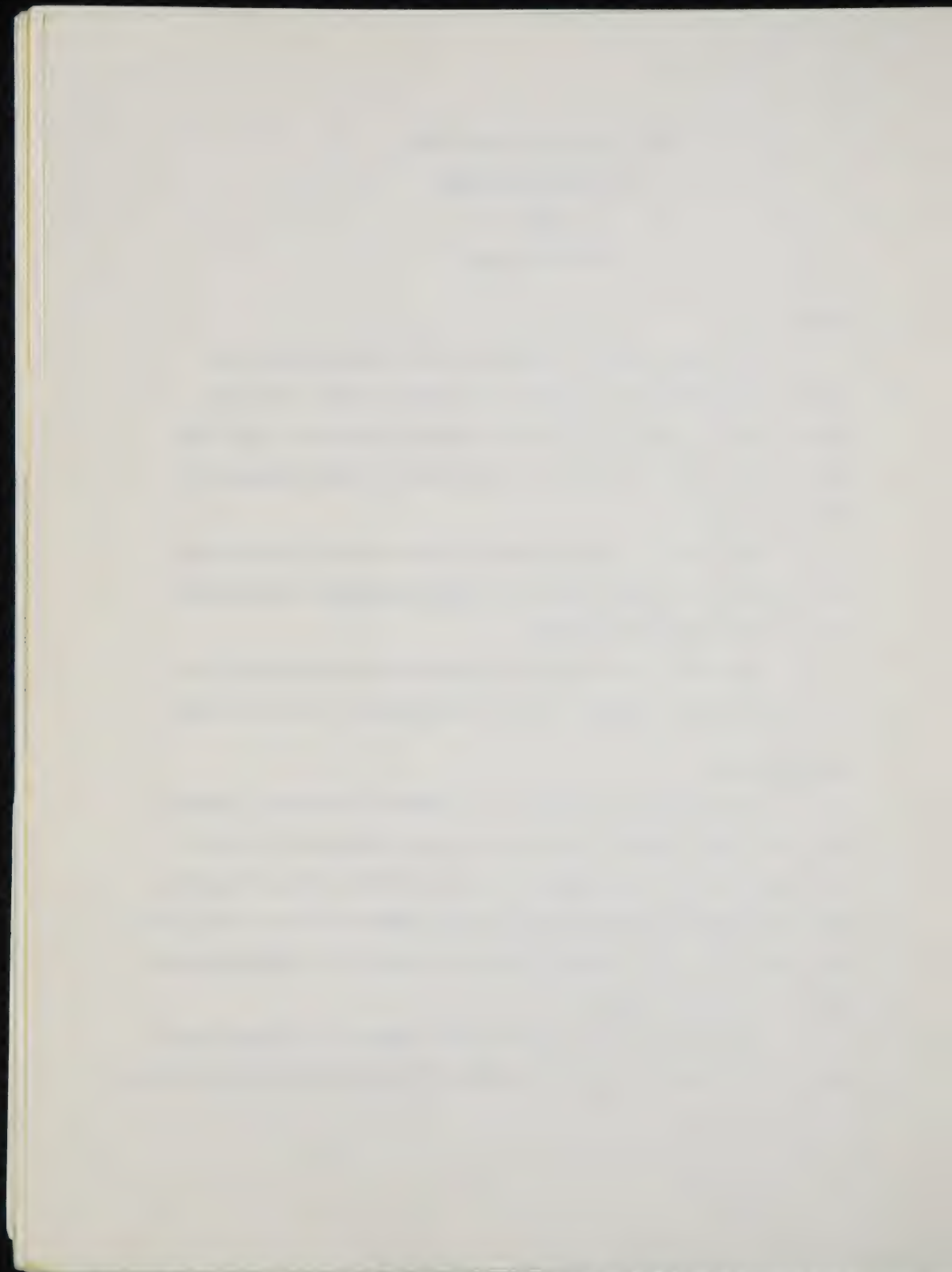
Sufficient forces and expertise were available from agencies most immediately concerned and no additional assistance was requested from the Water Resources Division.

An aerial inspection of the pipeline and the Athabasca River was made about the time that clean-up operations were being completed.

Responsibility

In keeping with the intent and purpose of the Water Resources Act, the Division approves pipeline watercourse crossings with terms and conditions as may be required to insure safety to the pipeline from damage or rupture arising from such erosion causes as flood, or ice action. Only that portion of the pipeline as may be contained in the watercourse channel has been considered.

Since the G.C.O.S. pipeline break occurred at a location other than a river crossing, the Water Resources Division had not been previously



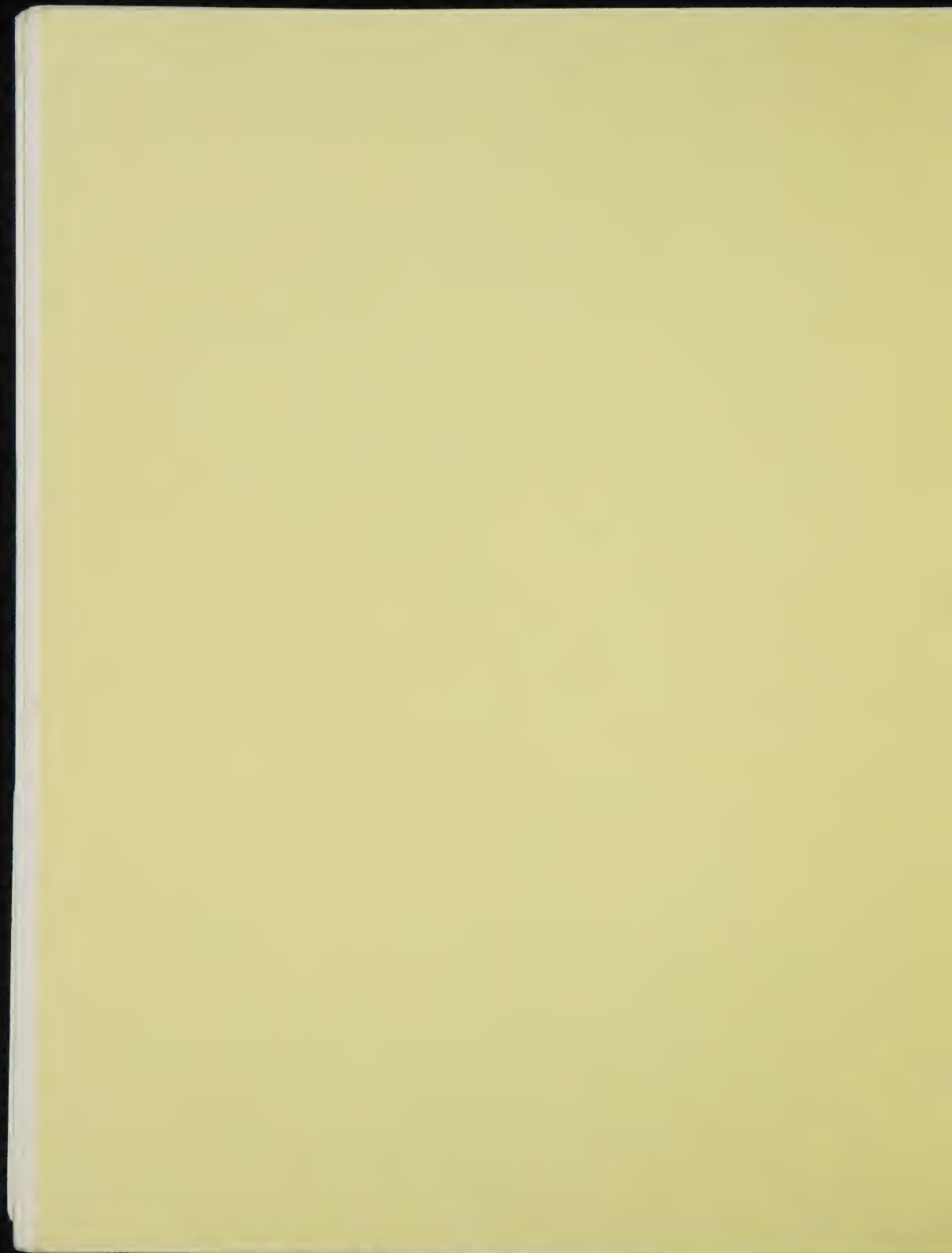
involved in that particular section of line.

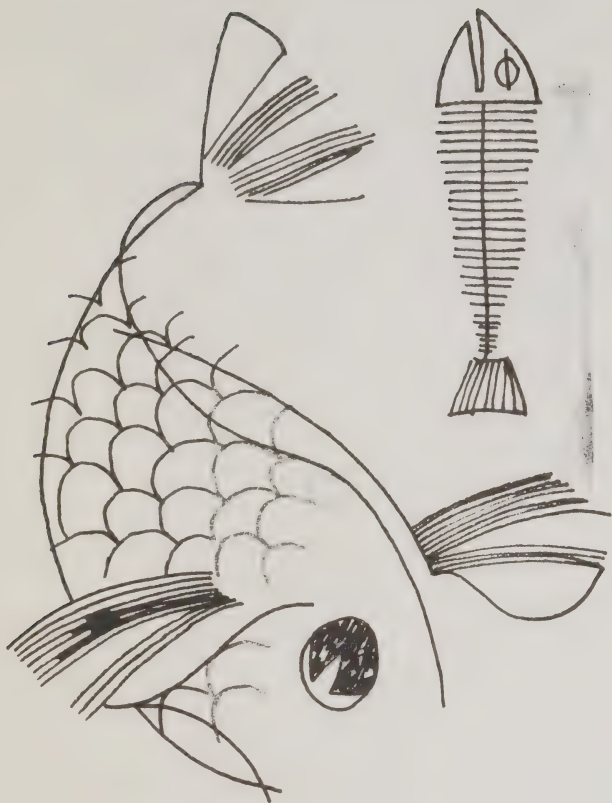
Future Prevention

Although the Water Resources Division does not have direct administrative responsibility for water pollution control, it does have an interest and moral responsibility as do various other agencies of government. It is appropriate therefore that the Division should undertake any measures that come under its jurisdiction which will assist in any pollution control objectives. Accordingly consideration is being given, jointly with the Pipeline Division of the Department of Mines and Minerals, to the introduction of additional safeguards with respect to pipelines located adjacent to water bodies.

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ENVIRONMENTAL HEALTH SERVICES DIVISION
GOVERNMENT OF THE PROVINCE OF ALBERTA
DEPARTMENT OF HEALTH

ATHABASCA RIVER OIL SPILL

JUNE 1970



S U M M A R Y

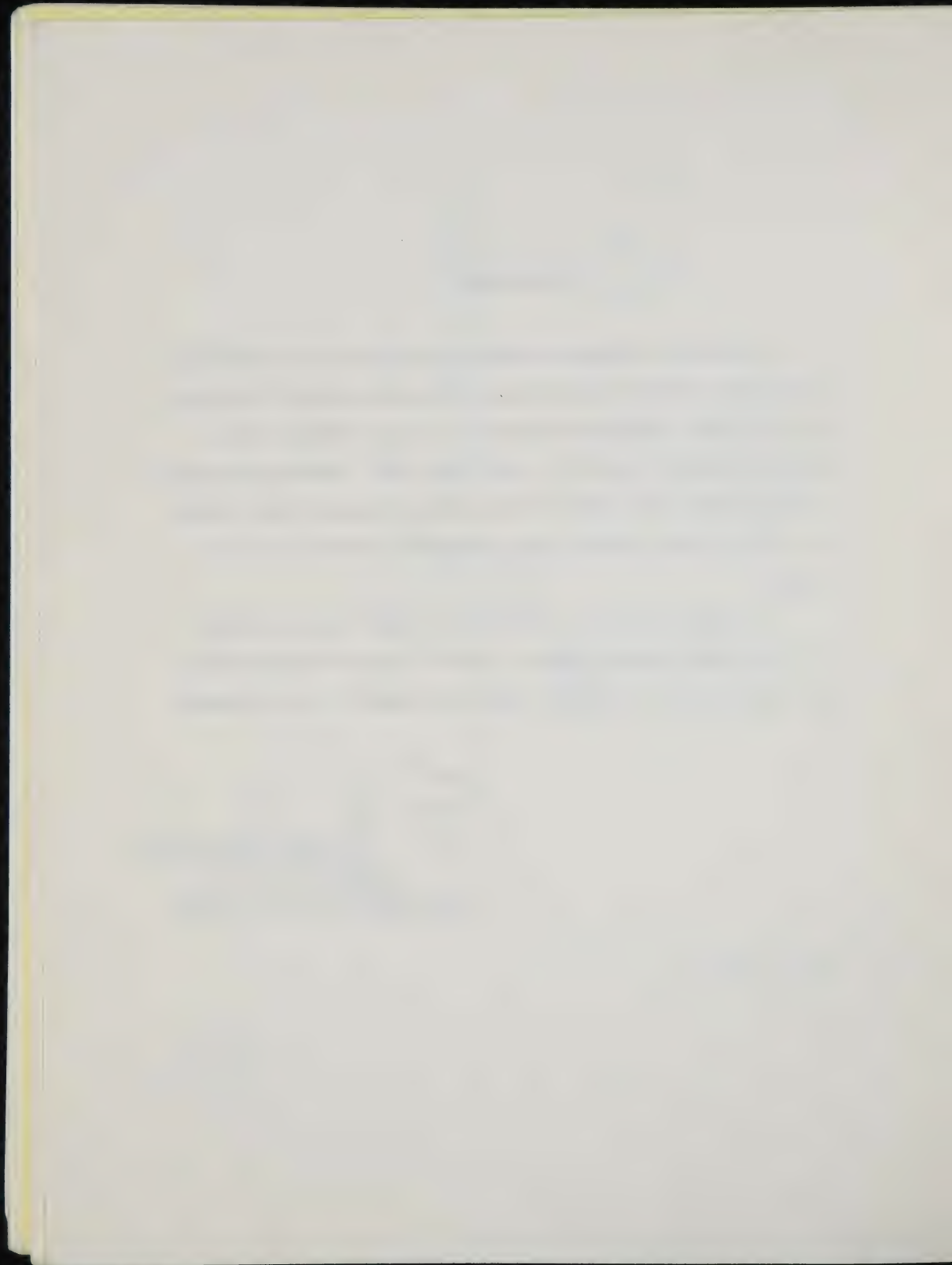
This report outlines the observations and activities undertaken by the Water Pollution Control Section during the duration of the oil spill from Great Canadian Oil Sands Ltd. into the Athabasca River during the period of June 8th to June 18th, 1970. A further inspection of the Athabasca River Delta and Lake Athabasca indicates that the oil has virtually been dissipated and no immediate problems seem to be apparent.

A contingency plan is also presented which strongly indicates that an agreement between members of the oil industry be undertaken to assist each other in the event of any major hazard to the environment.

A handwritten signature in dark ink, appearing to read 'E. E. Kupchanko'. The signature is fluid and cursive, with a large initial 'E' and a long, sweeping underline.

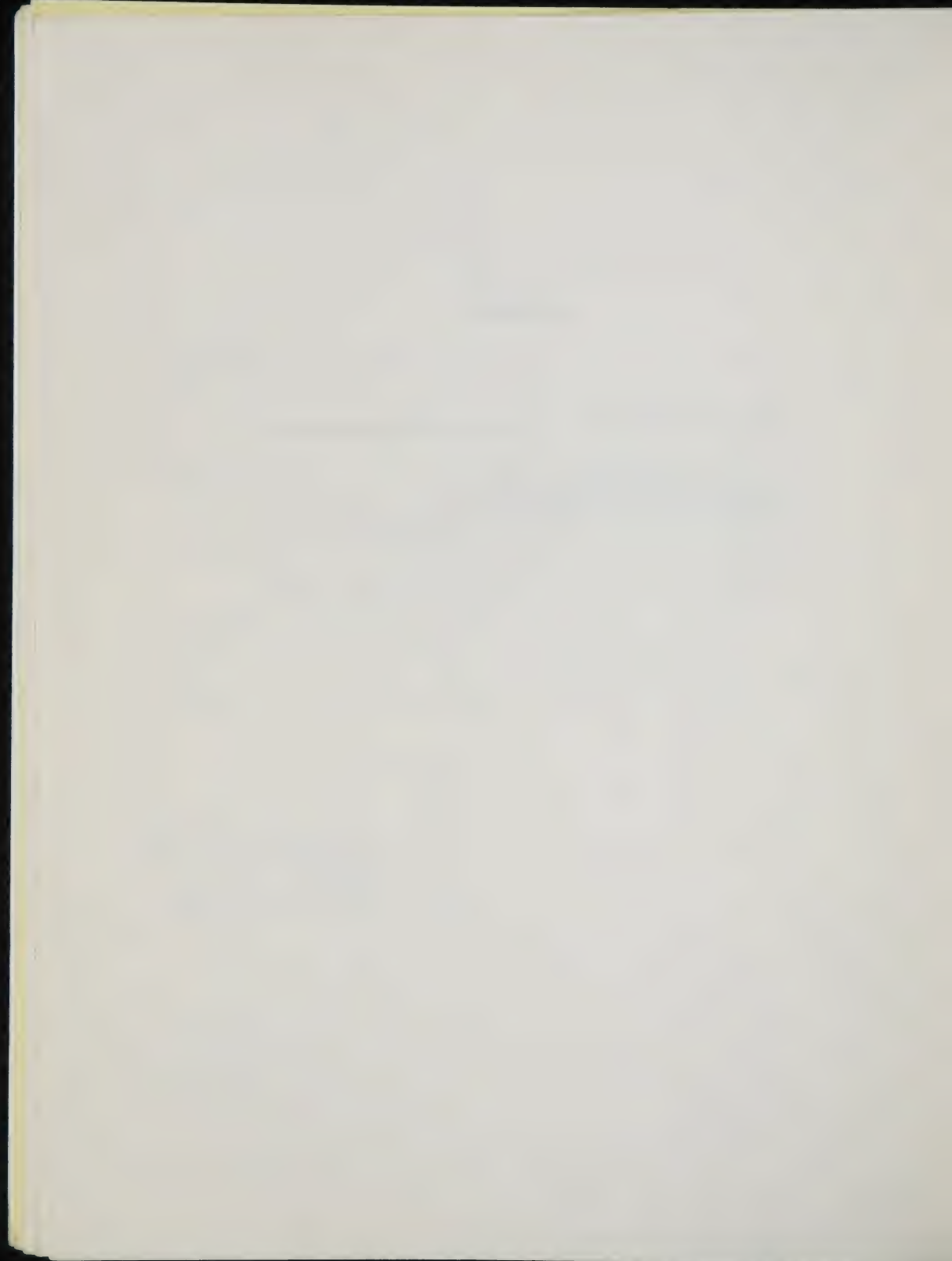
E. E. Kupchanko, P. Eng., Head,
Water Pollution Control Section

June 30, 1970



I N D E X

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FIELD INVESTIGATIONS

INTRODUCTION

An investigation of an oil spill near the Great Canadian Oil Sands plant at Tar Island was carried out during the period of June 8 - 18, 1970 and on June 25, 1970. The oil spill was due to a 32-inch longitudinal rupture in a 16-inch products line which carries synthetic crude from the plant to Edmonton, Alberta. The location of the break which occurred on the afternoon of June 6, 1970 was approximately one-half mile south of the plant tailings pond and approximately one-half mile from the river. This report summarizes the observations made on the river during this investigation.

OBSERVATIONS

An aerial survey of the river was made in the afternoon of June 8, 1970 (Figure 1). Between Tar Island and Fort McKay, an oil-water emulsion could be observed in a thin string along the west side of the river with some accumulation of oil in back waters. From Fort McKay to Bitumount, approximately 50 percent of the water surface was covered with an iridescent sheen. A greater quantity of oil-water emulsion could be seen, which varied in width from 10 to 30 feet from the west bank. The area between Bitumount and Embarras showed a dispersion of the iridescent film across the entire width of the water. The emulsion remained along the west bank in a string less than 10 feet wide. The emulsion could not be observed near Embarras. The leading front of the oil film was just downstream from Embarras.





AERIAL VIEW OF BOOM NEAR TAR ISLAND — JUNE 8, 1970



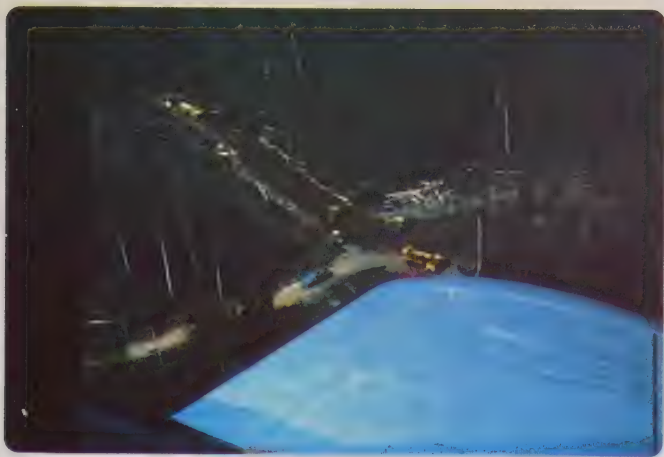
AERIAL VIEW OF ATHABASCA RIVER SHOWING
IRIDESCENT SHEEN — JUNE 8, 1970



IRIDESCENCE ON THE ATHABASCA RIVER — JUNE 8, 1970



CLEAN-UP OPERATION AT FT. MCKAY — JUNE 9, 1970
DISPERSANT BEING USED ON WEST SHORE



AERIAL VIEW OF PIPELINE RUPTURE AREA — JUNE 8, 1970



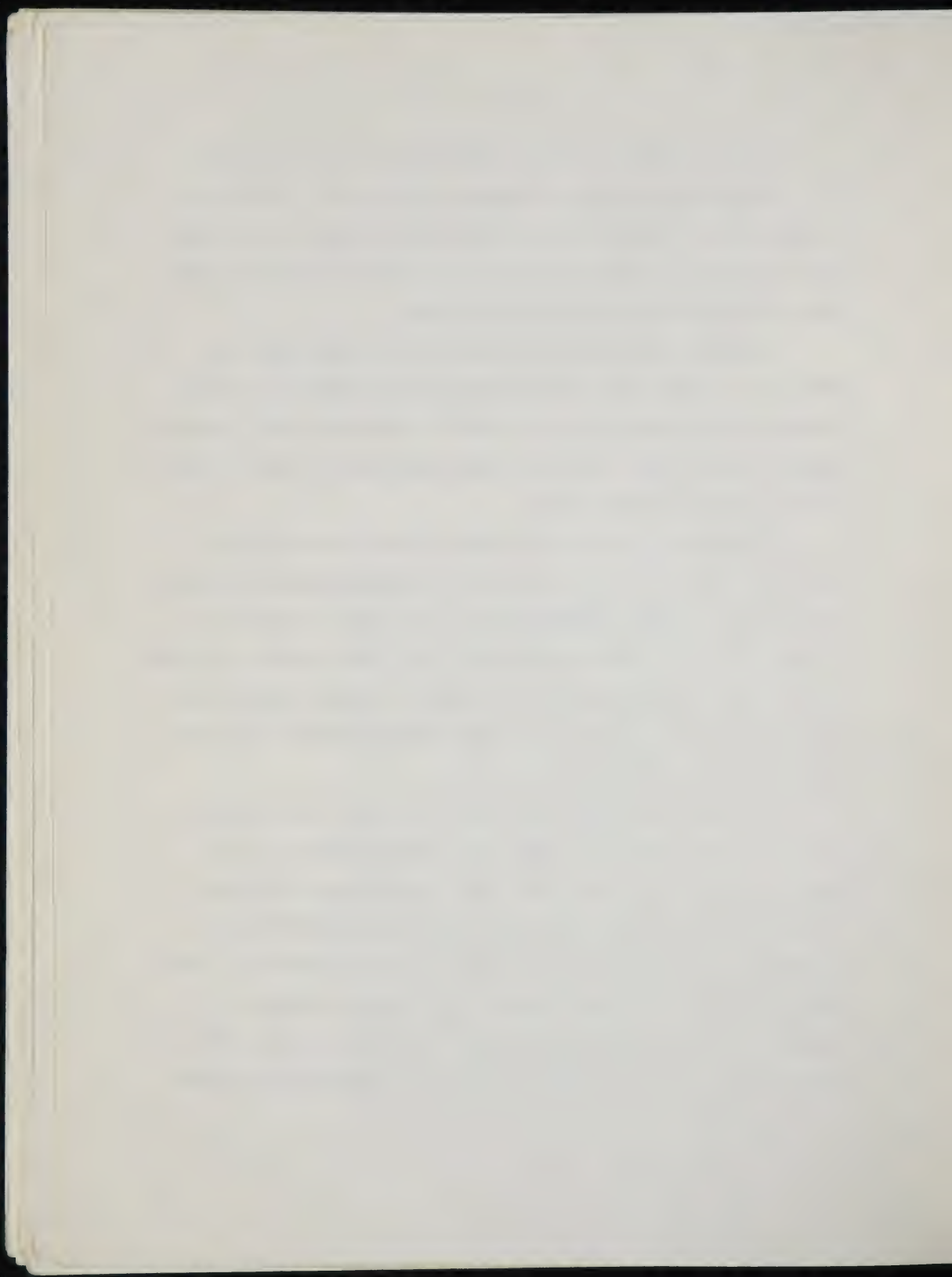
VIEW SHOWING PIPELINE — JUNE 9, 1970

A ground survey of the river at Fort McKay was made on June 9, 1970. Two crews were engaged in dispersing the emulsion, oil film and small pockets of accumulated oil along the river bank. The emulsion lay in a very thin broken line along the west bank from which the iridescent sheen spread out for approximately 30 feet.

A program to determine the effectiveness of Corexit 7664 was initiated. An area of the river downstream from Fort McKay was aerial sprayed with this chemical with two loads of 1,800 pounds each, containing 6 percent Corexit 7664. The location where the pipeline rupture occurred was also inspected during the day.

A meeting was held with Mr. A. Boggs of the Fish and Wildlife Division on June 10, 1970. He stated that the oil film could be seen for approximately 100 miles starting from five miles below Fort McKay. He reported sighting oil emulsion extending 10 to 25 feet from the west river bank. He also reported having to kill a beaver which was covered in oil and appeared to be in distress. Mr. Boggs' observations were made from a boat on June 8th and 9th, 1970.

Observations were again conducted from the air in the afternoon of June 10, 1970. During this flight, the iridescent film of oil was seen to be spotty downstream of Fort McKay to a point near Ells River confluence. Here a definite increase in the amount of oil film could be seen with very little evidence of emulsion or oil accumulation. First sign of emulsion was observed five miles downstream of Bitumont. The emulsion along the west bank was in a thin discontinuous string. The opposite bank was clear of emulsion. Near the confluence of the Firebag



River, a continuous sheen was observed throughout the width of the river. Pockets of oil and emulsion could be seen on the east bank. On the west side of the river, emulsion could be seen extending three feet from the bank. The width of the emulsion increased to 30 feet near Embarras, then decreased to a narrow string and completely dissipated near the 28th baseline.

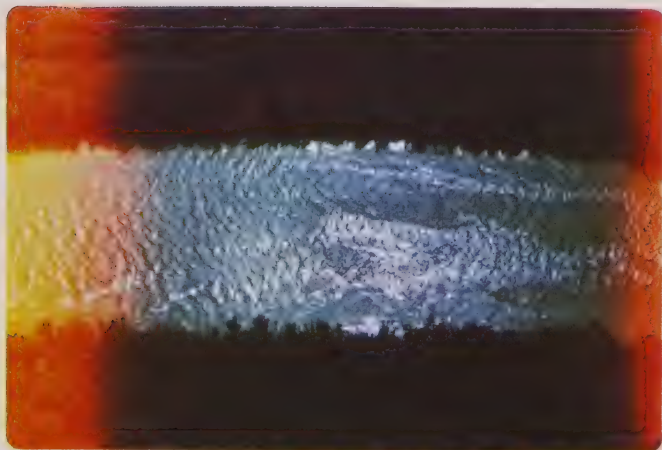
A meeting was held with Great Canadian Oil Sands officials on June 11, 1970 to formulate a method to contain the oil and emulsified oil from reaching Lake Athabasca. It was agreed to remove the emulsified oil from the west bank of the river and remove all free oil accumulation in back waters. Great Canadian Oil Sands stated that all necessary men and equipment would be moved to the Embarras location to stage a two front attack. Two crews would advance downstream from Fort McKay while two other crews would be engaged working upstream from Embarras. To make this operation successful, both chemical and mechanical methods would be used.

Another air surveillance of the river was made on the morning of June 12, 1970. Near Bitumount, a slight iridescence was observed. Emulsion was not noted until the point near the confluence of the Firebag River was reached. A ground level examination of the emulsion and the iridescent sheen was made near Embarras. The strings of emulsion were one quarter inch in thickness and broke up into globules when scooped up into the hand. The sheen which could be observed from the air was barely visible at water level. The amount of emulsion increased near Embarras Portage extending 20 feet from the north shore. Emulsion was also prevalent on the south

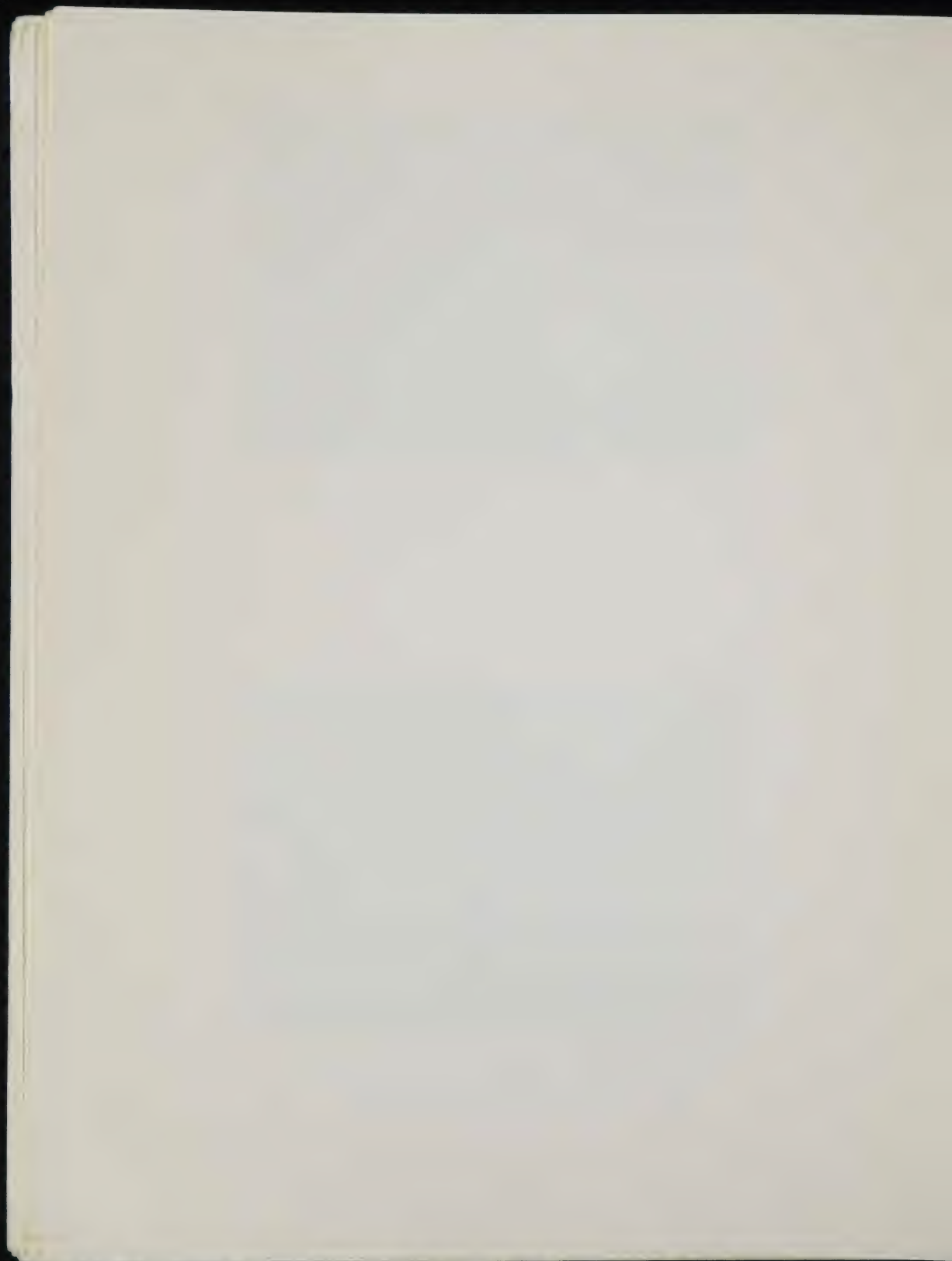




OIL-WATER EMULSION IN ATHABASCA RIVER
AT EMBARRAS — JUNE 16, 1970

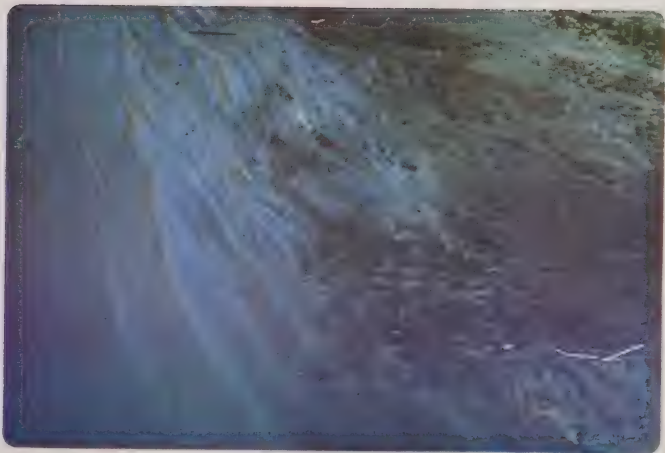


OIL-WATER EMULSION IN BIG POINT CHANNEL
AT BIG POINT — JUNE 16, 1970

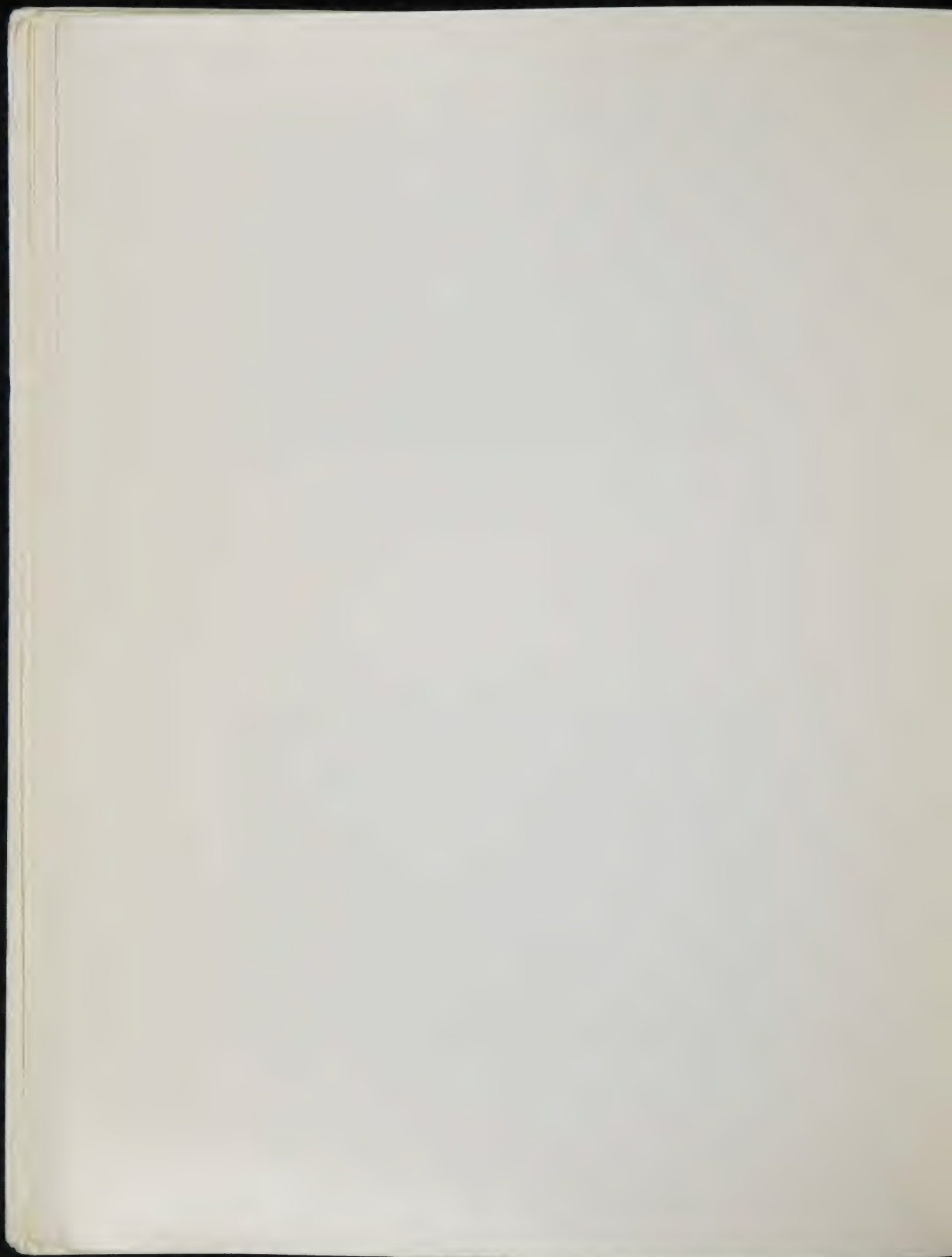




MOUTH OF BIG POINT CHANNEL AT LAKE ATHABASCA
JUNE 16, 1970



IRIDESCENCE OIL FILM ON DELTA SHORE LINE
JUNE 16, 1970

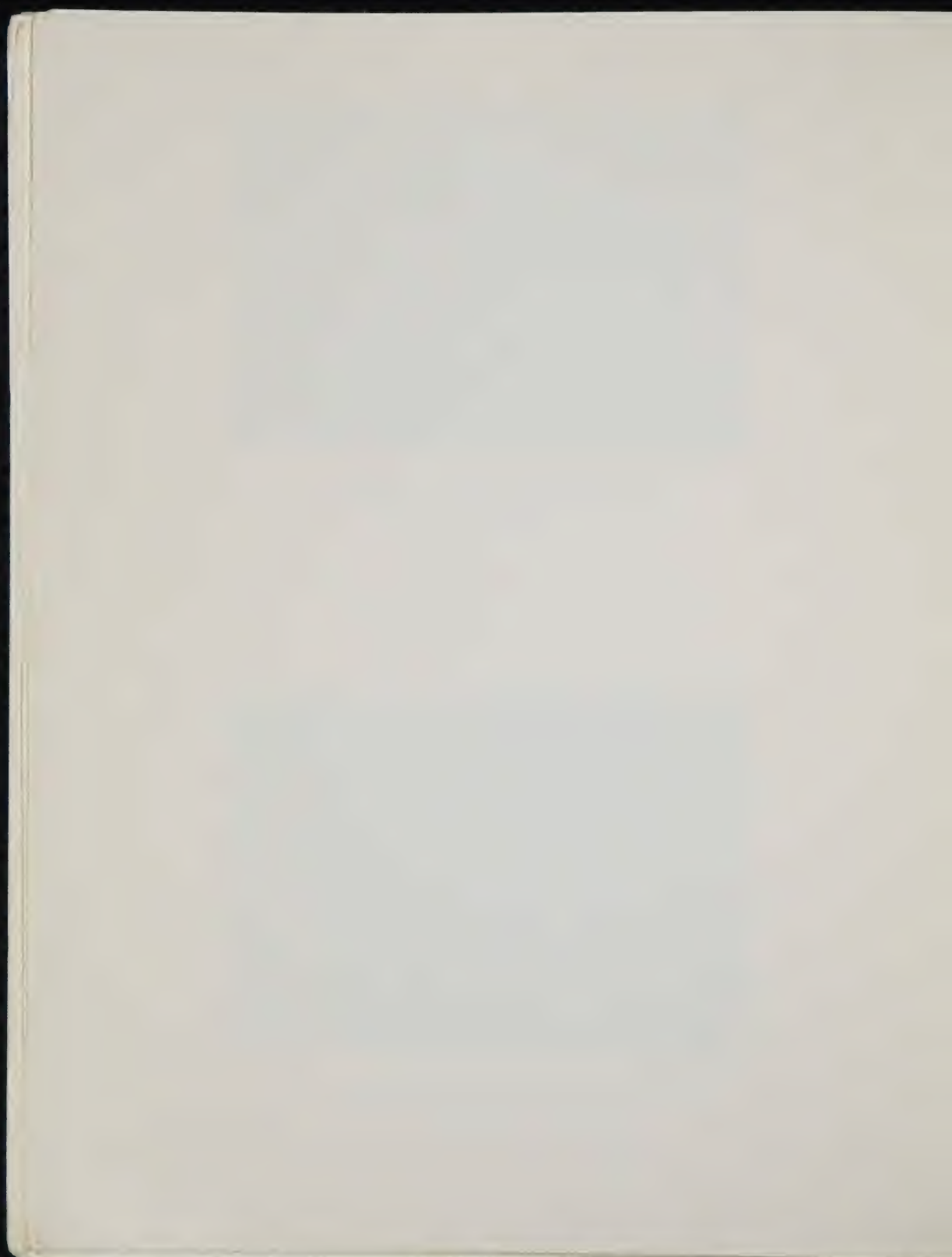




LAKE ATHABASCA AND DELTA SHORE LINE
JUNE 16, 1970



LAKE ATHABASCA — JUNE 16, 1970



bank with some accumulation of free oil in back waters. Free oil was observed in eddies approximately five miles downstream from Embarras Portage. The largest of the three oil patches was approximately 20 feet by 30 feet and one quarter to one-half inch in thickness. A survey of the main channels in the Delta area was also made. The film of oil had advanced to near the mouth of Fletcher and Big Point Channels but not into the lake itself. During this survey it appeared that the oil would be contained in the main channels of the Delta region.

One June 15th, Mr. Bland of G.C.O.S. stated that he had inspected the Athabasca River by motor boat on June 13th and did not detect any traces of oil or oil-water emulsion as far as 40 miles downstream of Tar Island.

An aerial survey of the Athabasca River between Fort McMurray and Lake Athabasca was conducted during the afternoon of June 16, 1970. First observations of the emulsion in the Athabasca River were sighted just north of the confluence of the Firebag River. From this point northwards to Portage, the emulsion occupied approximately 5% of the water surface coverage and was intermittently scattered along the Athabasca River in twisting formations ranging from 50 to 200 feet in length and varying 10 to 20 feet in width. Free oil was not observed.

In surveying the Embarras River, Fletcher Channel and Big Point Channel in the Delta area, it was noticed that the emulsion strips covered approximately 25% of the water surface. Small patches (20 feet by 2 feet) of iridescent oil film were scattered along the banks of these rivers near their mouths to Lake Athabasca. Very slight iridescence was observed on the calm shore waters of Lake Athabasca in an area north of the Delta and



between the mouths of the Embarras River and Big Point Channel. Iridescence was not evident in the main of Lake Athabasca north of the Delta where windy squalls and wave motions prevailed. A light iridescent film (500 feet by 20 feet) was observed fanning out into the northeast tributary leading to Richardson Lake. However, a surface boom had been installed below the 28th Base Line to contain free oil and the emulsion in Big Point Channel from spreading into Lake Richardson.

In Fort Chipewyan, a meeting was held with Mr. D. Steven of the Canadian Wildlife Services who indicated that:

- (1) a boom was being constructed to prevent the flow of oil into Des Rochers River;
- (2) application of emulsifiers to Lake Athabasca was discontinued because of potential secondary effects and the oil appeared to have been dispersed by wind action;
- (3) biological studies on aquatic life were being initiated to determine long term effects;
- (4) a "slick licker" barge was being evaluated to determine its capability in the mop-up operations.

Surface water samples were obtained from the Athabasca River, the Delta channels, and Lake Athabasca by officers of the Department of Lands and Forests on June 8-9, 1970. The concentration of oil and grease ranged from 1.8 mg/l downstream of Tar Island to 12.8 mg/l at Mills Island (Figure 2). No oil was visible in these samples.

River water samples collected between McDermott Island and Chipewyan I.R. contained a 1/8" - 1/2" oil layer on top. Considerable suspended solids were evident in the samples. It is assumed that oil



adhered to this sediment, thus giving high results ranging from 2500 mg/l to 713 mg/l at these respective locations (Figures 3 and 4).

Oil was not present in samples collected from the Athabasca River and Delta channels between Point Brule and Lake Athabasca on June 9, 1970. The concentration of oil and grease ranged from 2.0 mg/l at Point Brule to 0.3 mg/l at Lake Athabasca (Figures 4 and 5).

During the afternoon of June 17, 1970, sub-surface samples were collected with a Kemmerer sampler (Figure 6). The concentration of oil and grease ranged from 0.6 mg/l at Big Eddie Bend in the Fletcher Channel to 0.0 mg/l near Potato Island in Lake Athabasca. Intermittent formations of emulsion were observed in the Delta channels at up to 10% water surface coverage. The emulsion was noticeable at elevated heights but not at ground level.

On June 18, 1970 Mr. A. Galbraith of G.C.O.S. stated that mop-up operations were continuing in the vicinity of the ruptured pipeline. It was anticipated that clean-up operations in the Delta and Lake Athabasca would be completed by the weekend of June 20-21, 1970.

Mr. A. Boggs, Fish and Wildlife Officer, stated that no traces of emulsion or free oil were observed during a motor boat inspection of the Athabasca River from Fort McMurray up to Lake Athabasca at Fort Chipewyan on June 20-21, 1970.

An aerial survey of the Athabasca River, Delta and Lake Athabasca was conducted on June 25, 1970. Emulsion or oil was not evident in these bodies of water. All surface booms (Des Rochers River, Lake Richardson) were removed. A dike of straw bales had been constructed on the west bank of the Athabasca River near the site of the G.C.O.S. ruptured pipeline. This measure would prevent leeching of any residual oil or emulsion



from the immediate area into the river by surface run-off or the fluctuating crest of the river.

Sub-surface water samples of the Athabasca River and Big Point Channel were obtained at Big Eddy and the south end of Tokyo Syne (Figure 7). Oil and grease concentrations were 1.1 mg/l and 0.6 mg/l at these respective locations. These analytical results are considered to be minimal. The aerial inspection of the Delta also indicated that the oil has virtually dissipated and no immediate problems seem to be apparent.



REFLECTIONS AND COMMENTS
ON THE ATHABASCA OIL SPILL
WITH RESPECT TO FUTURE DEVELOPMENT

PREVENTION PLANS

The primary elements of any oil spillage are essentially -

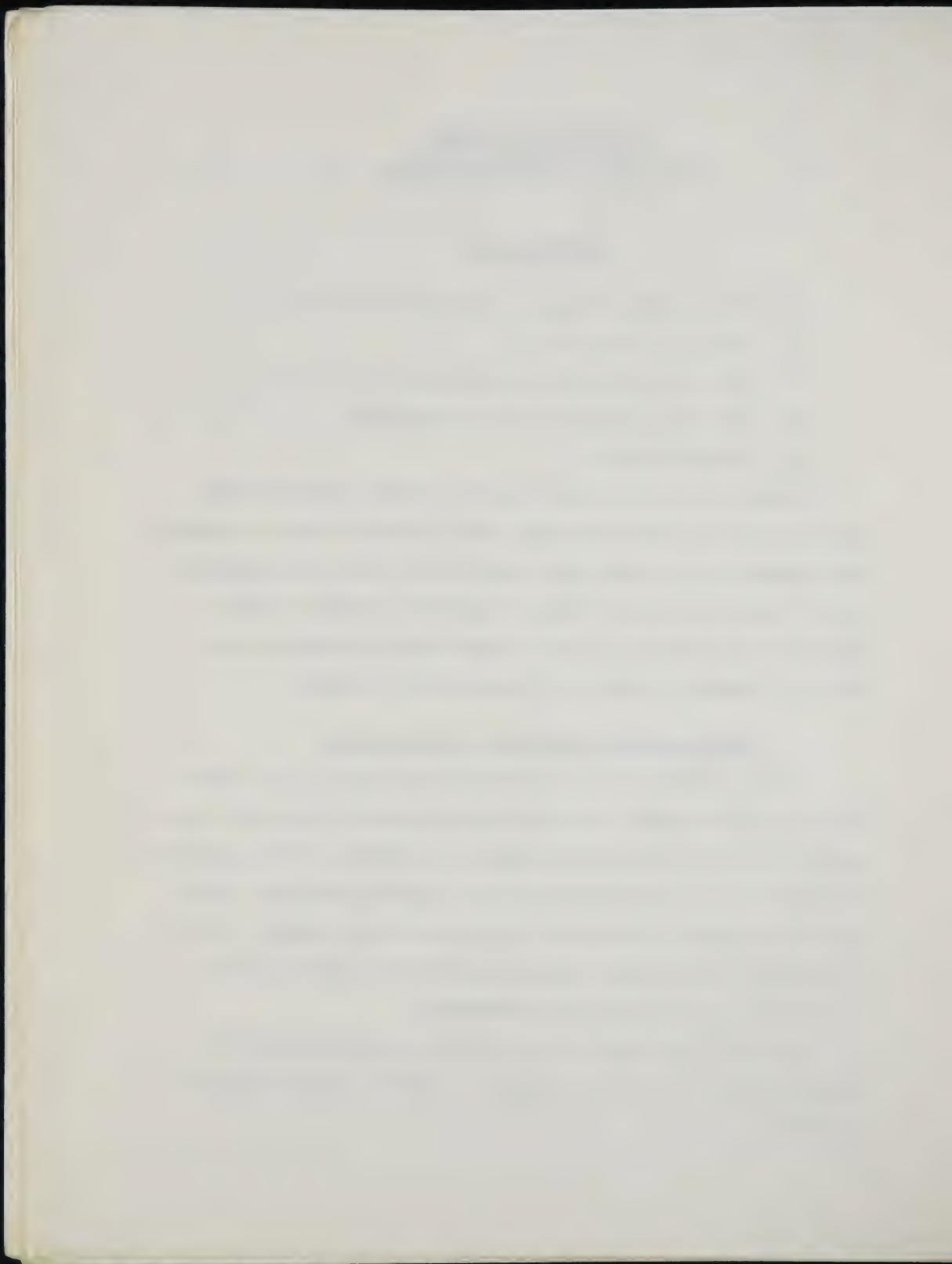
- (1) Prevention of the oil spill
- (2) Control or limiting the consequences of the oil spill
- (3) Restoration of the shore face and waterfowls
- (4) Ecological effect:

Pipelines and storage tanks should be designed, constructed, and tested according to established safety codes. Pipelines should be equipped with automatic shut-off valves that stop flow if a break in the pipelines occurs. Most refineries and loading terminals are equipped to handle relatively small spills. It cannot be emphasized too strongly that the best way to handle oil spills is to prevent their occurrence.

SURVEILLANCE AND PREDICTION OF SPILL BEHAVIOR

Aerial reconnaissance of oil spills is far superior to any surface based surveillance system. Large areas can be observed in relatively short periods of time, and the economics gained are significant. Many sophisticated techniques of surveillance are available and include photography, spectrophotometric, infra red, ultraviolet, radar and microwave imaging. It must be remembered that the higher level of sophistication requires skilled personnel for operation and data interpretation.

In general, the capability of oil slick behavior is not too well advanced largely due to the great number of variables involved (all time dependent).



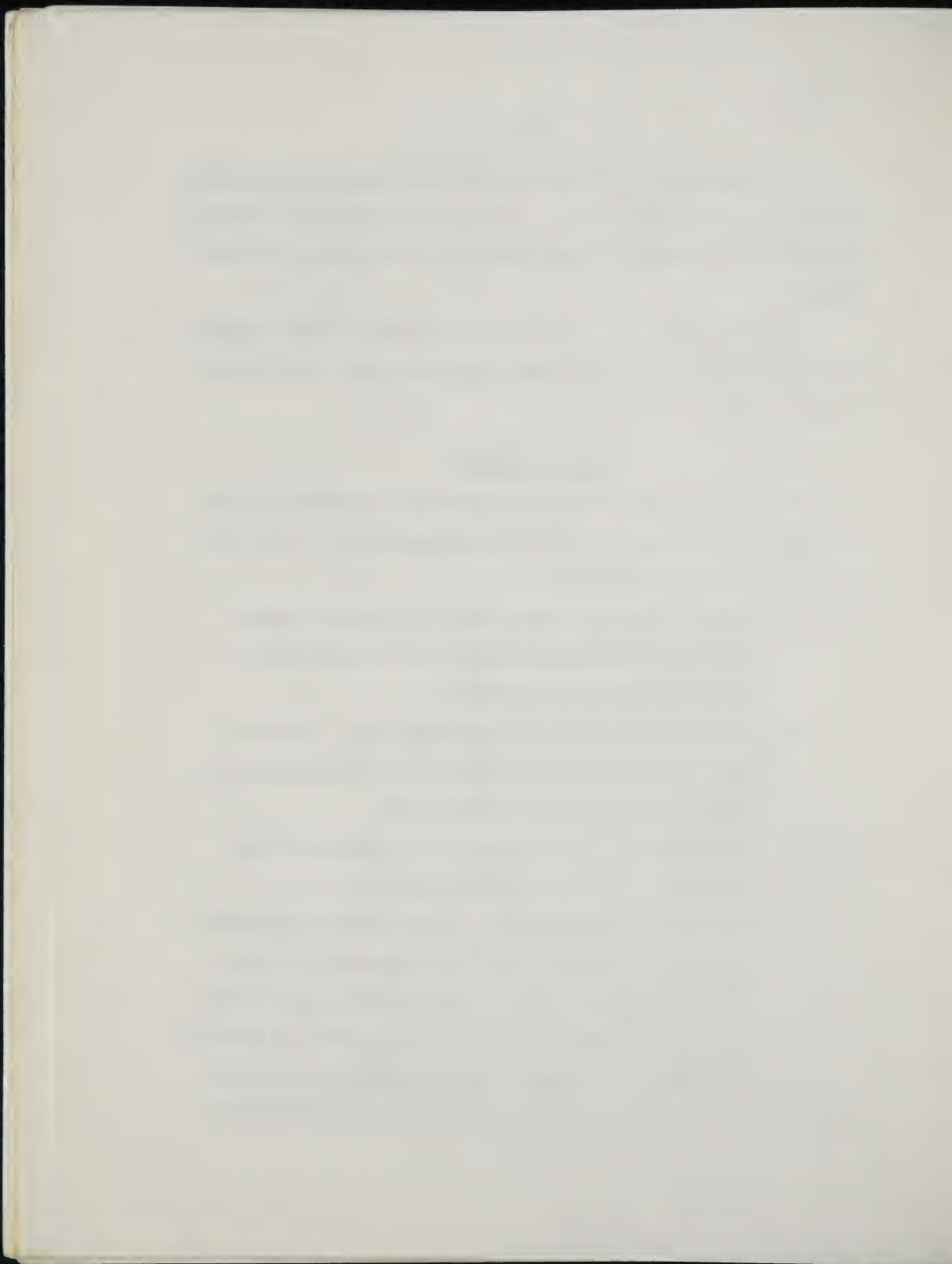
The boundaries of oil spills in rivers and streams can be defined, however the relative emulsification rate cannot be predicted. Similarly, the amount of oil remaining in back waters and on the banks is difficult to predict.

In lakes, slicks will be affected most strongly by wind conditions and can be expected to move at a speed approximately two to four percent of wind velocity.

CHEMICAL TREATMENT

There are a number of compounds and materials available to treat oil slicks. Five classes of collecting agents are generally available for oil slick recovery. These are:

- (1) Floating substances such as Peat moss straw and sawdust.
The floating substances are inexpensive and can readily be disposed of by burning or burial.
- (2) Plastic materials such as polyurethane foam. The use of plastics and other similar materials are rather expensive. Oil can be reclaimed for subsequent use.
- (3) Gelling Agents. Gelling agents that solidify petroleum compounds are still in the development stage.
- (4) Emulsifiers and dispersants. A large number of dispersants is available, however very little quantitative or comparative information exists. These materials may be toxic to aquatic life to some degree although several low toxicity dispersants are available. These dispersants break up the oil into particles of one to five micron size and expose a



very large surface area of the oil to natural biological degradation. The low toxicity dispersants available include "Gulf 1009" & "COREXIT 7664" for dispersing crude oil and light fuels and "COREXIT 8666" for heavy fuels. The general conclusion after experience with a number of incidents such as the Torrey Canyon and the Arrow is against the general use of emulsifiers. In general, physical collection is preferred if possible.

- (5) Absorbents. Numerous solid absorbents for sinking oil are available. Aquatic organisms may be affected adversely and resurfacing of the oil is possible although delayed in action.

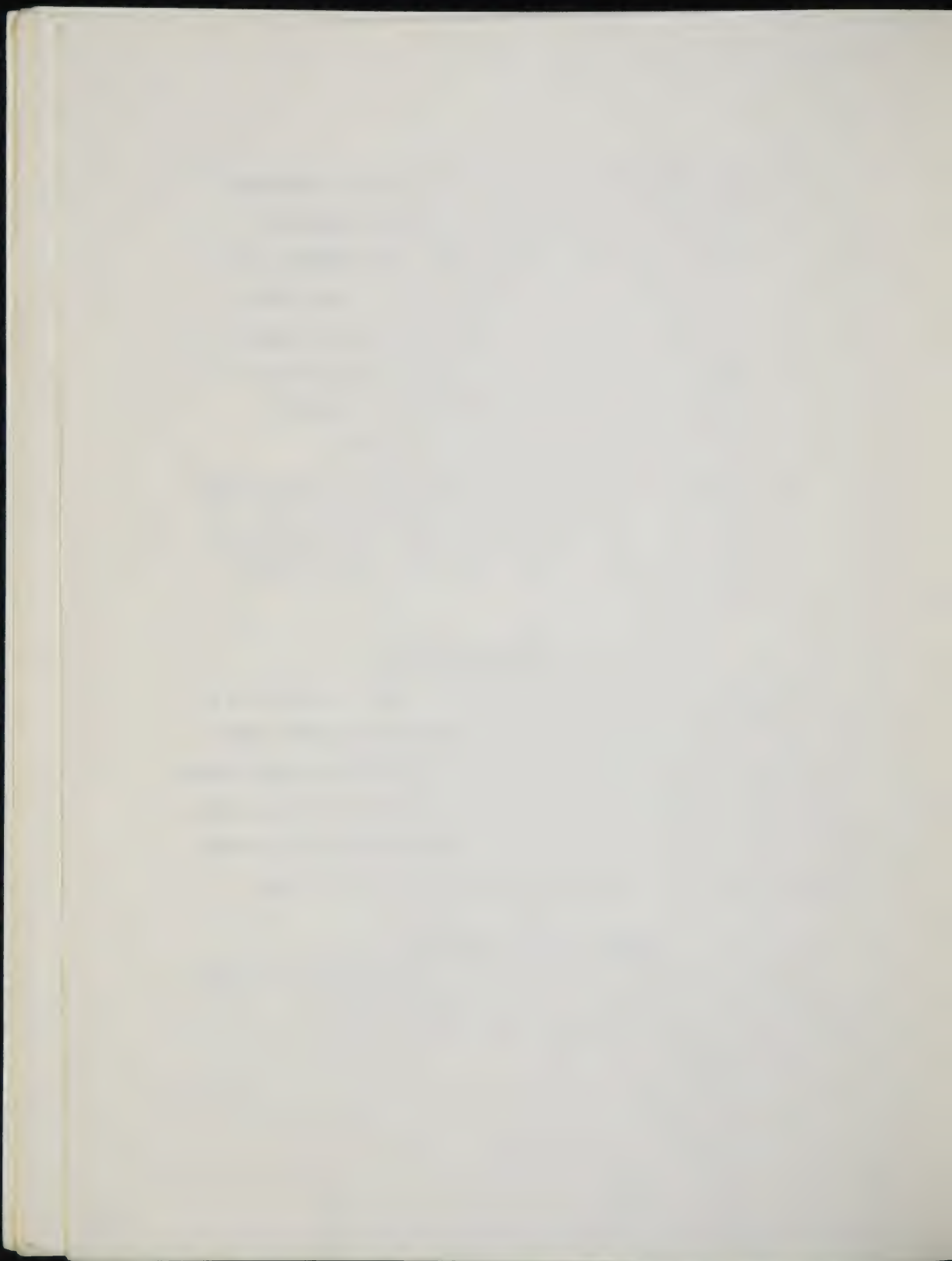
BIOLOGICAL DEGRADATION OF OIL

Biological degradation of hydrocarbons in water is controlled by environmental conditions such as nutrients, temperature, oxygen availability, degree of dispersion of oil in water and micro-organisms present. Under fairly warm conditions, biological degradation can occur in a matter of days. However, this process is greatly decreased under cold weather conditions. Generally, degradation rates appear to be very slow.

PHYSICAL METHODS OF TREATMENT

There are generally three practical physical methods of oil slick recovery all interdependent on each other. These include -

- (1) Booming
- (2) Burning
- (3) Skimming

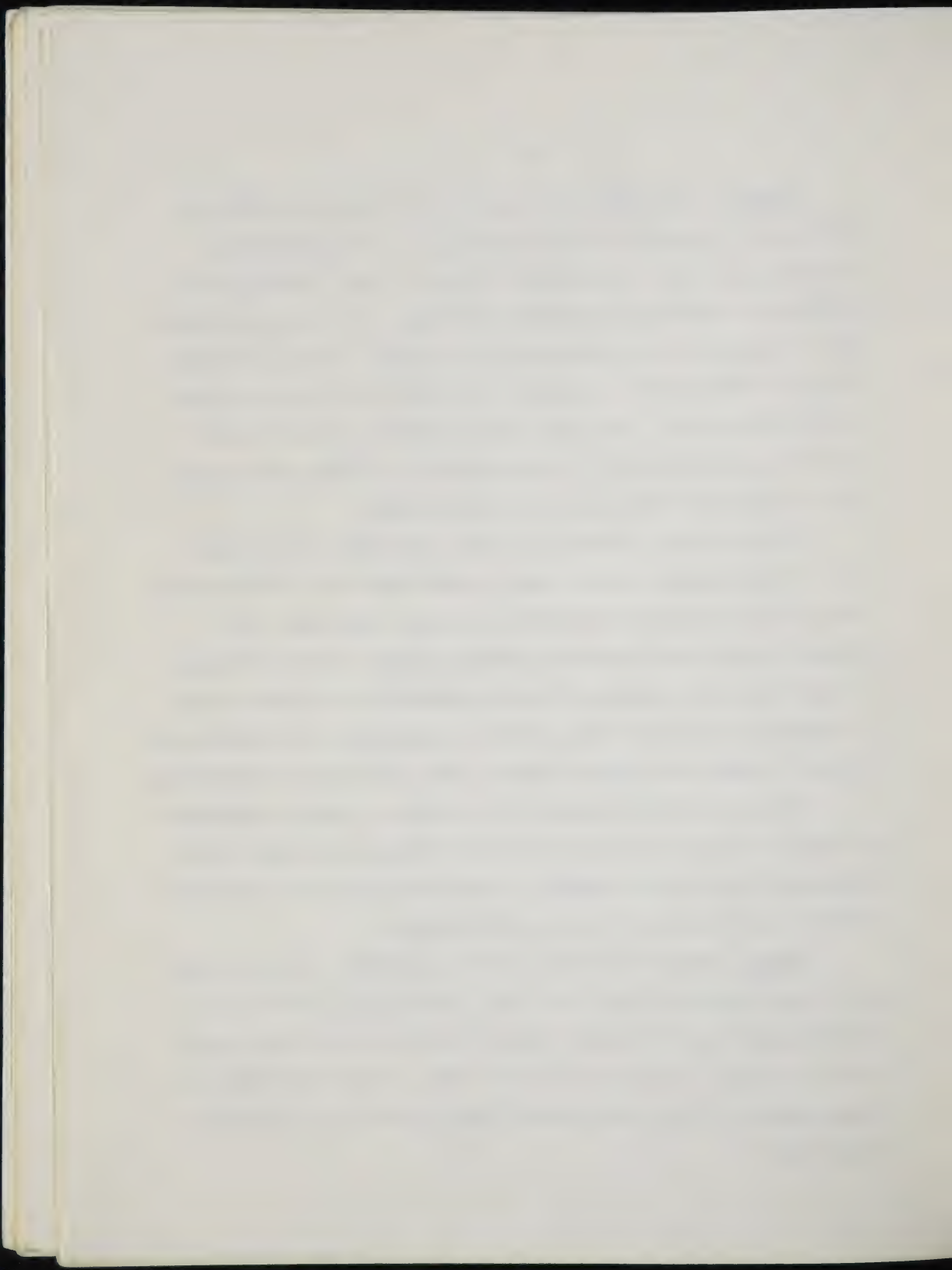


Booming - Containment of oil spills can be effectively handled by using booms. The ability to confine a spill in the area immediately surrounding the source is principally a function of time, availability of equipment, and prevailing environmental conditions. There are two principal types of mechanical barriers applicable to oil spills: floating booms and underwater bubble barriers. Generally, both methods are suitable only for relatively calm water. The floating boom generally is more portable and involves less erection time. The disadvantage of the bubble barrier is the loss of contaminant in the event of air supply failure.

Different types of floating booms are: wood floats, logs, rubber floats (large diameter neoprene coated), canvas covered cork, chain-weighted boom suitable for permanent installation and plastic type boom. It is extremely important that the boom is readily available for quick placement, is light enough to be handled with limited manpower and can contain the oil in the area used even with strong currents and rough water. The plastic type of boom is probably most suitable because of its ease of storing and handling.

For any oil removal equipment to be effective, it must be modularized and capable of aerial transport and delivery within a short period of time. The equipment must also be compatible. Experience has shown that booms from different manufacturers could not be joined together.

Burning - Burning on the water surface is generally not too effective due to rapid transfer of heat to the water. Burning of oil soaked straw or other materials may be effective. Burning of light fractions such as gasoline may be useful. Burning on the surface water, in lakes and streams is severely hampered by the lack of overall control and of the possibility of forest fires.



Skimming - Mechanical devices for collecting oil from the surface water such as suction pumps, rotating cylinders and belts are available, however the capacity of these units are relatively small. Their use is restricted to relatively calm waters or in areas where the oil layer is quite thick. Overall costs for removing of oil (from harbors) ranges from \$1.35 to \$3.00 per gallon.

RESTORATION

Physical removal of the contaminated material on the banks of streams and lakes with appropriate earth moving appears to offer the best solution. Addition of absorbing material such as straw, sawdust or clay can assist pickup. Plowing under is unsatisfactory because the water may ultimately cause resurfacing of the oil.

Detergent cleaning has been used in combination with mechanical filling.

It appears that physical removal with the assistance of absorbents as necessary and possibly backed up by limited use of detergents is the best method of restoration.

BIOLOGICAL AND ECOLOGICAL EFFECTS

Attempts to clean large numbers of oiled birds and animals are futile. Of the many thousands of oiled birds captured and treated following the Torrey Canyon incident, a small percentage recovered. Small concentrations of petroleum products and derivatives are toxic to aquatic organisms. Due to the diluting effects of the water, the concentrations that would be directly lethal to the aquatic organisms may not always be reached. There may be a number of subtle effects,



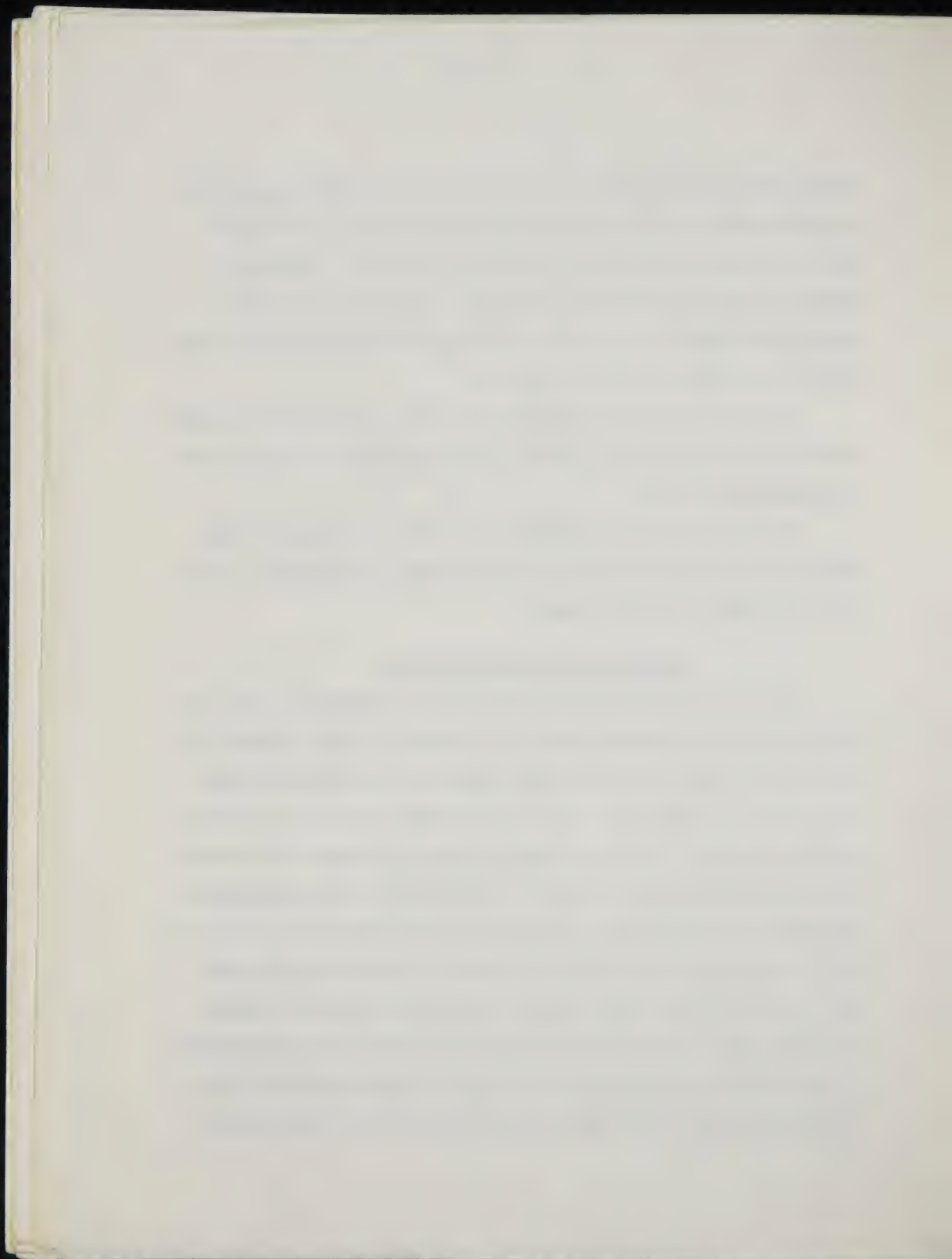
however, that may escape the casual observer. These subtle changes may be more prominent during certain periods of the animals' life stages or when environmental conditions are marginal for survival. Tainting of aquatic organisms especially fish may result. Such indirect effects warrant more detailed study before any categorical statement can be made on the overall effect of aquatic organisms.

Oil pollution generally changes the species composition of bacteria present in the water so that forms utilizing petroleum as an energy source temporarily predominate.

Many detergents and demulsifiers are toxic to bacteria, protozoa and other microscopic organisms in the food chain. In some cases, their toxicity exceeds that of oil alone.

BIOLOGICAL AND CHEMICAL EVALUATION

Both the Fish and Wildlife Division of the Department of Lands and Forests and the Environmental Health Division share a mutual concern for surface water quality and the potential hazard of pollutants affecting the ecological balance of the natural environment. The Fish and Wildlife Division represents expertise in several phases of freshwater and wildlife ecology, physiology, and toxicology. The assessment of the environmental requirements for aquatic life and wildlife and the determination of environmental concentrations of potential toxicants that are not harmful under long-term exposure are areas that are investigated by the Environmental Health Division. Surveillance of an oil spill incident involves prediction of the behaviour of the spill and evaluation of the effectiveness of the clean-up operations. The immediate short-term effects of an accidental

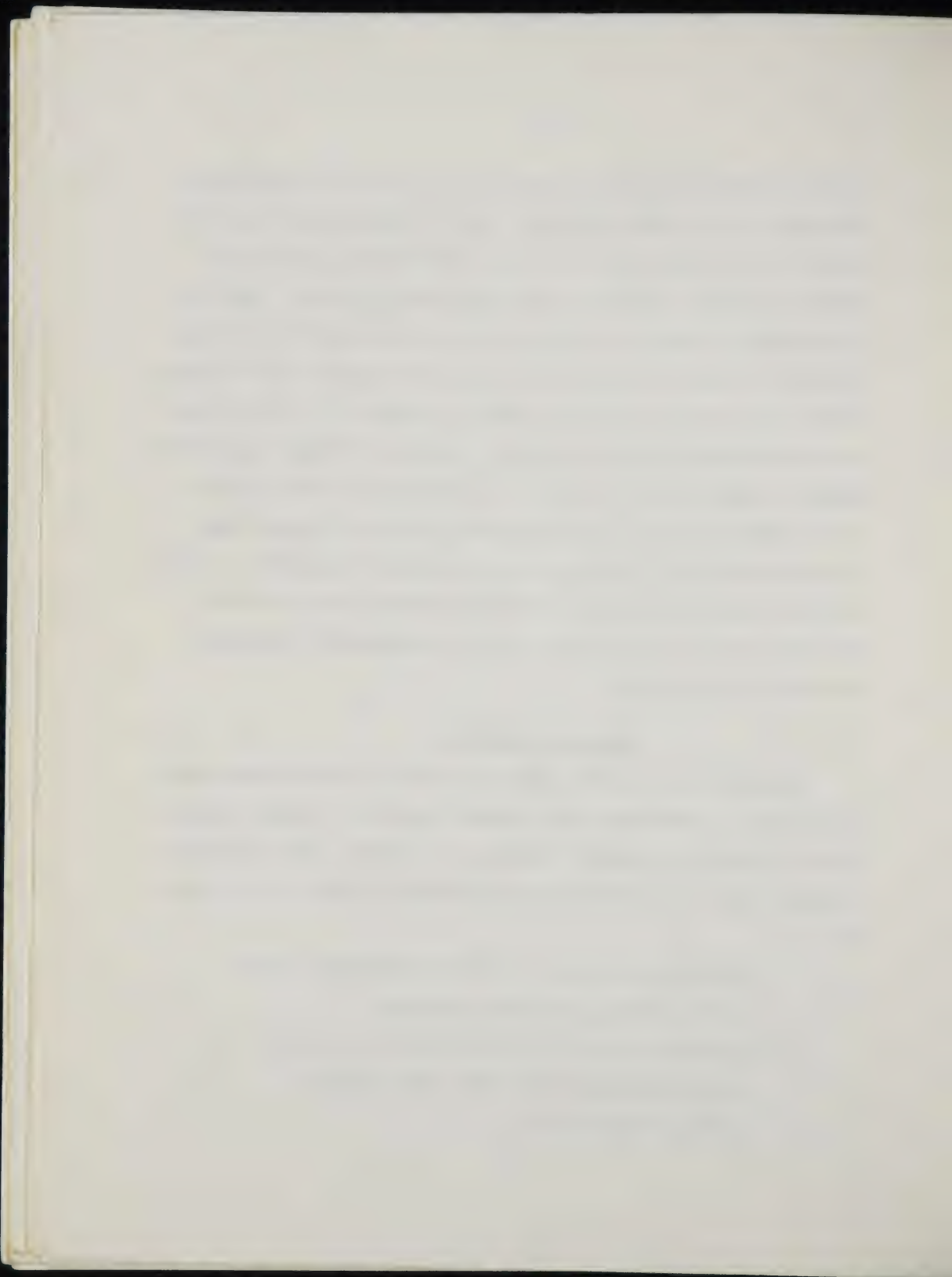


oil spill on water fowl, fish, beaver, etc. can be objectively evaluated. For example, oil can cause tainting of fish or edible invertebrates. Oil sludge deposits on the shores or bottom of the receiving body of water may become effective toxicants to sensitive benthic organisms. Depending on the extent and magnitude of the oil spill, the ecological deviation may or may not be immediately apparent. However, stabilization of the ecological balance in the contaminated body of water will occur after sufficient time has elapsed to allow biological activity to recover to normal. The chemical analyses of water samples performed by the Environmental Health Division and the biological data and long-term studies of aquatic life and fauna by the Fish and Wildlife Division serve to complement one another. A policy of strong liaison between the two departments exists to this extent and this greatly assists in providing a basis for comprehensive evaluation of any water pollution problem.

CONTINGENCY PLANNING

Contingency planning for coping with major oil and hazardous chemical spills should be undertaken with a systematic approach. Planning should be focused on specific geographical locations in relation to river basins and navigable lakes. The contingency planning should be directed specifically at -

- (1) Providing an estimate of accident probability including severity location and path of pollutant.
- (2) Reviewing sectors of the economy and resources that might be affected and how these might dictate or restrict control methods.



- (3) Establish where necessary a warning and communication network to be activated in the event of an emergency including an inventory of equipment and supplies and their sources, and sources of real-time environmental data that may be required in the event of an emergency.
- (4) Provide for a rational basis for stockpiling control of restoration equipment and materials (and by what agency).
- (5) Establishing specific plans of action for selected situations of higher estimated probability and severity.
- (6) Identifying significant control measures that must be taken in advance.

It is recommended that an agreement between members of the oil industry in Alberta be made that in the event of a fire, spill release or other emergency which endangers the environment, the companies will assist each other by providing the available materials, equipment and manpower to deal with the situation.

Any party to this agreement responsible for the occurrence will be responsible and pay for the cost of equipment and material provided by the other parties used in combatting the emergency. If the responsibility for the emergency cannot be ascertained, then each of the parties will share the cost of the equipment.

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P. Shewchuk

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P. Shewchuk, P. Eng.
Water Pollution Control Section

A P P E N D I X

FIELD SURVEILLANCE OF ATHABASCA RIVER

AND DELTA AREA

Figure 1. Athabasca River and Delta Area

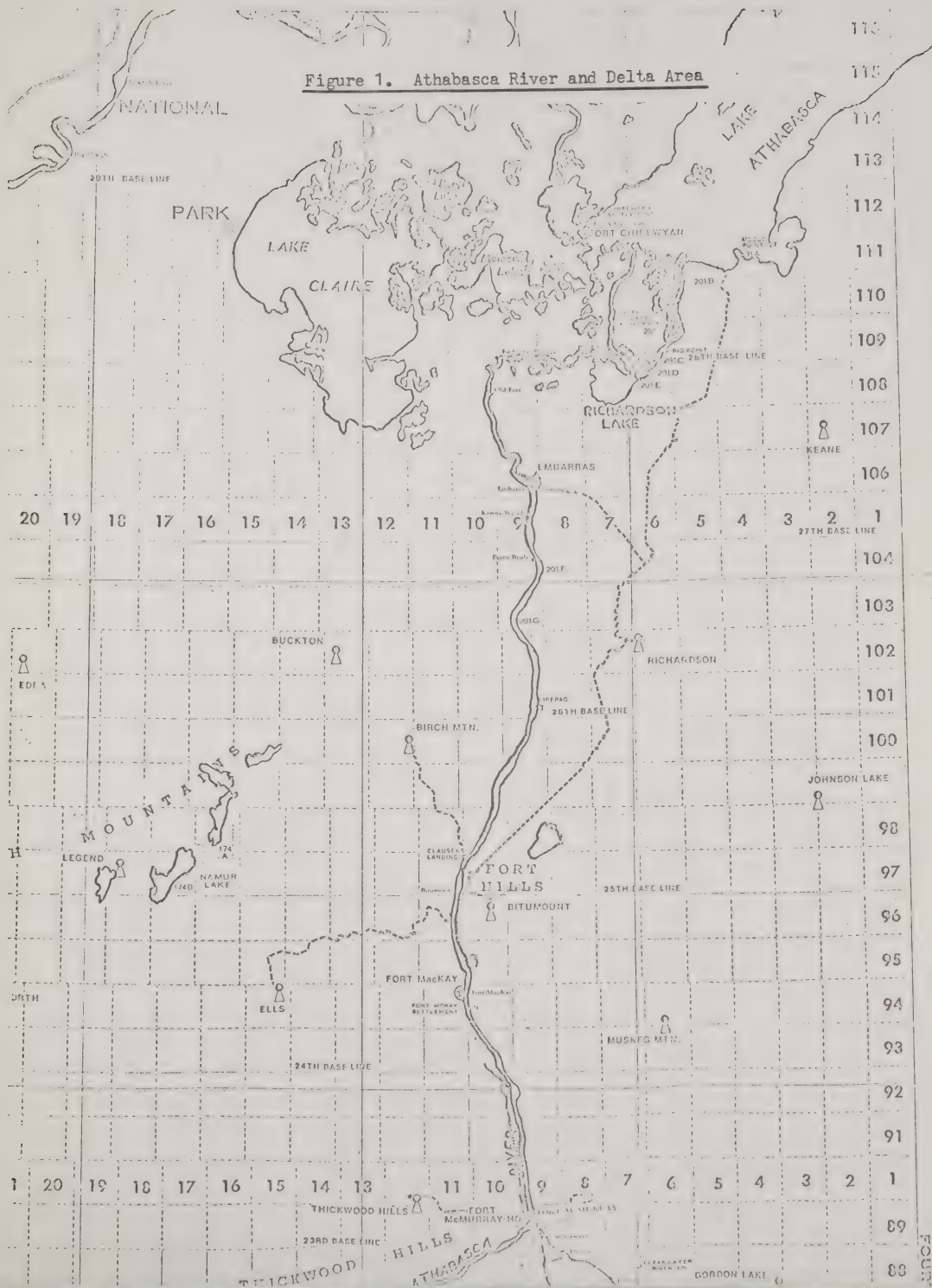


Figure 2. OIL AND GREASE (mg/l) IN SURFACE
WATER SAMPLES - June 8, 1970

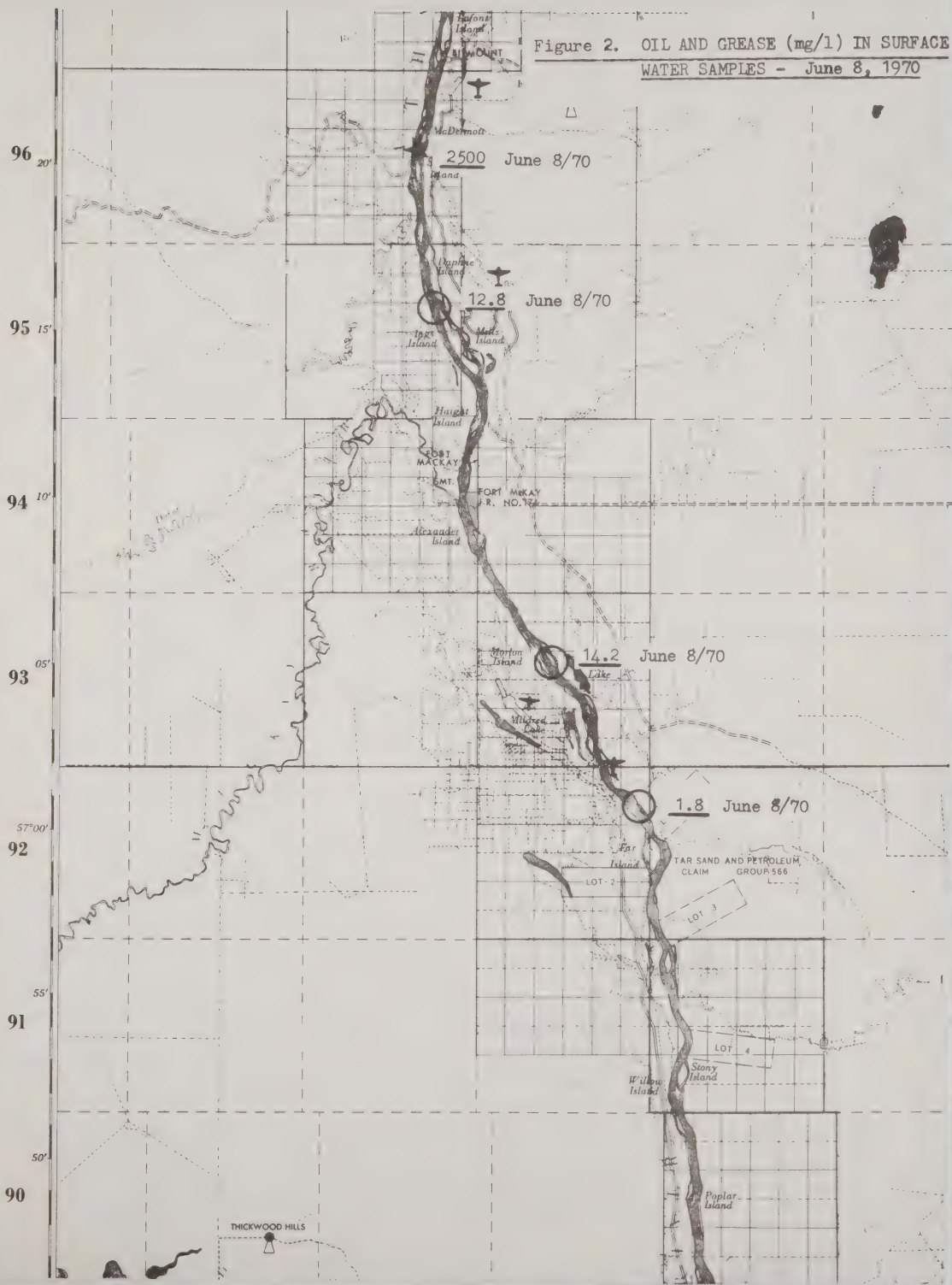




**Figure 4. OIL AND GREASE (mg/l) IN SURFACE
WATER SAMPLES - JUNE 9, 1970**



**Figure 5. OIL AND GREASE (mg/l) IN SURFACE
WATER SAMPLES - JUNE 9, 1970**



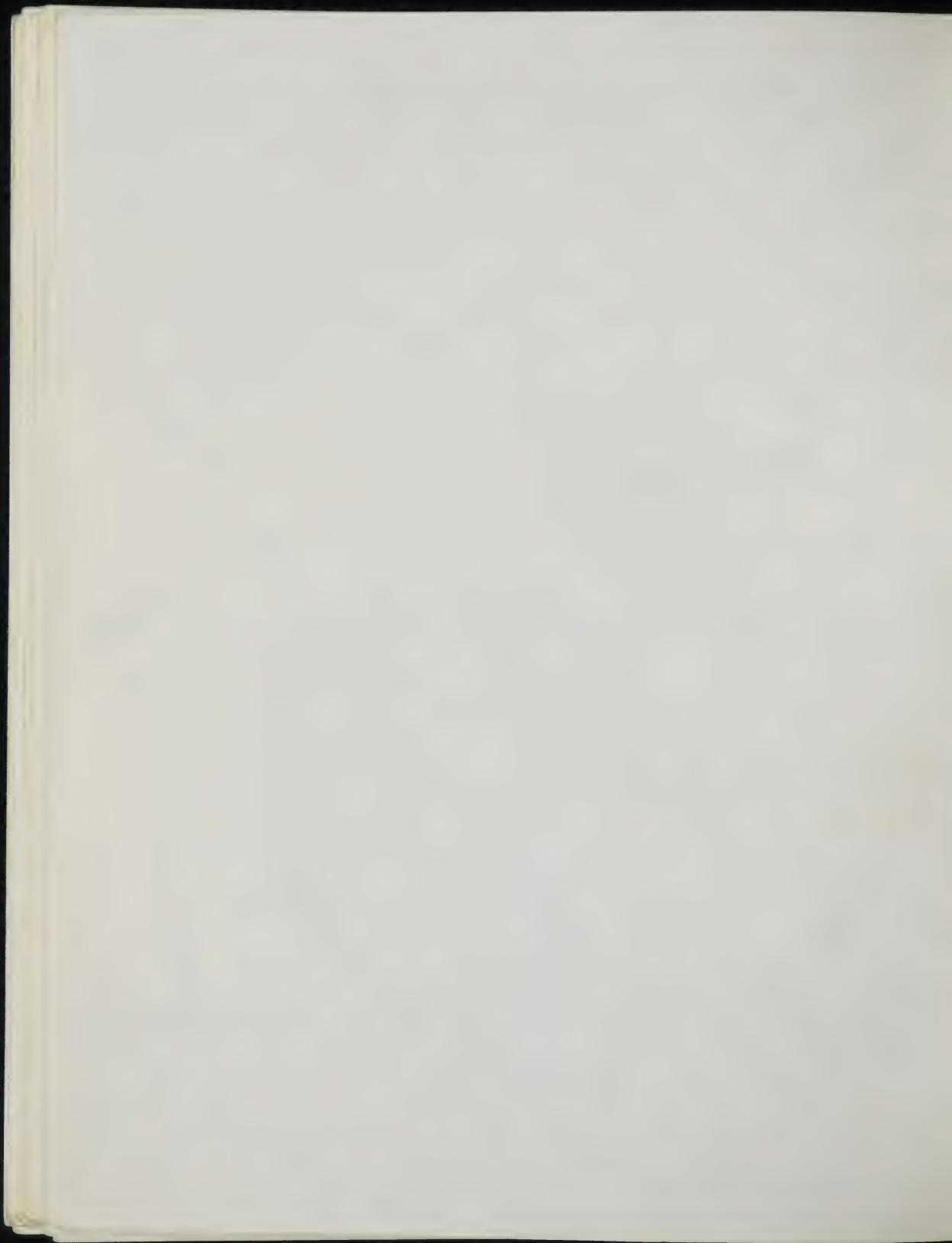


Figure 6. OIL AND GREASE (mg/l) IN SUB-SURFACE WATER SAMPLES -

JUNE 17, 1970



Figure 7. OIL AND GREASE (mg/l) IN SUB-
SURFACE WATER SAMPLES -
JUNE 25, 1970



DATE DUE	
DUE CAM MAY 18 '83	
RETURN MAY 4 '83	
DUE CAM MAR 06 '87	
RETURN MAR 20 '87	
DUE CAM MAR 20 '87	
RETURN	
DUE CAM MAR 20 '87	
RETURN	
DUE CAM NOV 24 '88	
DUE CAM DEC 08 '93	
RETURN	
DUE CAM MAY 01 1995	
RETURN DEC 15	
RETURN OCT 29 '96	
RETURN APR 07 '98	
RETURN APR 11 '00	

Due 30 MAY 01 1995

DEC 15 RETURN

RETURN OCT 29 '96

DEUTSCHLAND 1897

RETURN	APR 11 '00
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ALBERTA GOVERNMENT COMMITTEE
REPORT ON GREAT CANADIAN OIL
SANDS OIL SPILL TO ATHABASCA
39433125 SCI



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report on Great Canadian Oil
Sands oil spill to Athabasca
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